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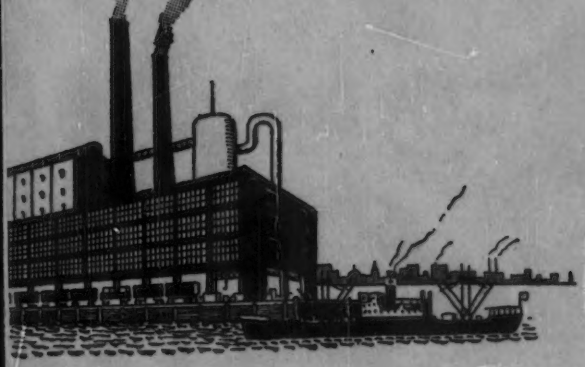
ECONOMIC GEOGRAPHY



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This magazine publishes articles in the field of economic geography as well as articles in adjacent fields that contribute to an understanding of the world's economic patterns.

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ECONOMIC GEOGRAPHY

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RAYMOND E. MURPHY, J. E. VANCE, JR., AND BART J. EPSTEIN

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ECONOMIC GEOGRAPHY

VOL. 36 JANUARY, 1960 No. 1

EVALUATING STORE SITES AND DETERMINING STORE RENTS

Saul B. Cohen and William Applebaum

Dr. Cohen is Associate Professor of Geography, Boston University, and a consultant in location analysis and research. Mr. Applebaum is Visiting Consultant on Food Distribution, Graduate School of Business Administration, Harvard University, and has initiated many of the location research techniques now employed throughout the supermarket industry.

MODERN mass retailing requires a large capital investment for store facilities whether these be in shopping centers or free-standing locations. It also requires the retailer, whether he is owner or tenant, to commit himself to a location for a relatively long period. For these reasons he cannot afford to make any serious mistake in selecting and evaluating a store site. Furthermore, he must be circumspect in negotiating store leases.

The purpose of this article is to outline:

1. Major considerations in evaluating a store site.
2. Factors which determine store rental.
3. The need for analyzing more methodically and scientifically proposed store locations.

Our interest in evaluating a site for a store is to determine sales and profit potentials. Profit is tied to sales. Therefore, a site evaluation begins with an estimate of sales that can reasonably be expected with suitable store facilities.

Several market factors are taken into consideration in this evaluation:[1] accessibility, population, competition, economic stability, and trading area boundaries.[2]

ACCESSIBILITY

Accessibility is a concept that is usually employed in a qualitative and relative sense. A site that has good accessibility is one that can be easily reached by customers and employees. "Easily reached" implies short distances and ease of driving, which means absence of friction. It is often used in a comparative sense to describe a site that is *more* easily reached than that of a competitor or of a prospective competitor.

[1] All examples and illustrations used in this article are based upon actual cases that have been observed and analyzed by the authors.

[2] For downtown type locations, number and composition of pedestrian traffic is also a major factor in evaluating a site. Among the first to discuss the technique for converting pedestrian traffic into customer traffic and sales potential was Delbert S. Wenzlick in "Pedestrian Traffic," *National Real Estate Journal*, August 18, 1930, pp. 19–24.

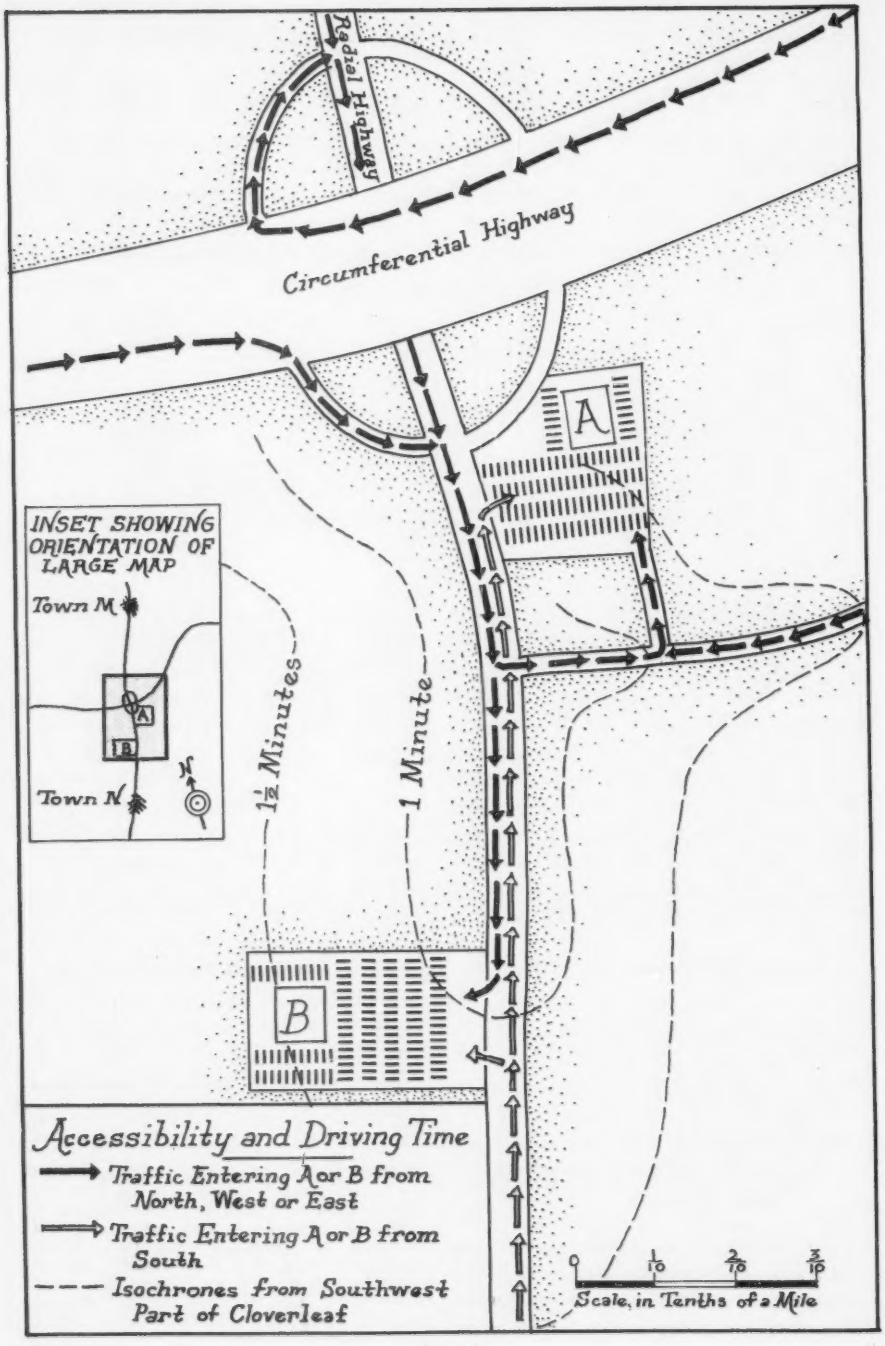
Radial Highway
Circumferential Highway
A
B
INSET SHOWING ORIENTATION OF LARGE MAP
Town M
Town N
1½ Minutes
1 Minute
Accessibility and Driving Time
Traffic Entering A or B from North, West or East
Traffic Entering A or B from South
Isochrones from Southwest Part of Cloverleaf
0
1/10
2/10
3/10
Scale, in Tenths of a Mile

FIG. 1.

Various elements are examined in evaluating accessibility. One that can be quantified is road surface conditions. Site approaches, including feeder roads, that are unpaved, pitted with pot holes, or characterized by steep gradients that create winter driving hazards, give poor accessibility to a site.

Another element that can be rated quantitatively is time-distance. A site may adjoin a major freeway at a cloverleaf, and nevertheless have poor access. This can be described in time-distance terms. An example would be Store A, located at the southeastern edge of a cloverleaf that connects a circumferential freeway with a major radial highway (Fig. 1).* The only direct entrance to the site is from the right-hand side of the radial highway for northward-moving traffic. All traffic moving off the circumferential freeway, or southward down the radial highway must take a left turn on a winding feeder road well to the south of the site. All traffic departing from the parking lot must use the feeder road and drive at the rate of 20 m.p.h. Total distance from the cloverleaf to the site's parking lot via this feeder road is 0.5 miles. Most automobiles, therefore, have to drive one mile, or three minutes, to get into and out of the lot.

Competitive Shopping Center B that is 0.6 miles south of the cloverleaf on the opposite side of the radial highway is closer in driving time to traffic coming from all directions. Traffic moves at a rate of 35 m.p.h., and the total time to and from the cloverleaf is about two minutes. In this instance, then, the advantage that Store A has over the shopping center in being located closer to the towns to the north, east, and west is completely cancelled out because of poor accessibility.

The utility of micro-isochrones is, of course, related to the size of the trading area and to the distribution of its population. In the case just cited, the competitive stores are supermarkets, and one minute's driving time includes a significant part of the trading area. If large department stores were involved, one minute's driving time would not be significant.

It is more difficult to rate quantitatively such elements of accessibility as traffic flow and visibility. Existing traffic flow is a magnet that attracts retail establishments. It can, however, create considerable friction and hamper a site's accessibility (Fig. 2). Shopping Center C is located on a four-lane undivided highway leading from the Central City to its farthest suburbs and satellite cities. This highway carries through truck, bus, and auto traffic. Curb parking, feeder streets, and lights reduce the traffic capacity of the four lanes to 1600 autos per hour. Since the highway's carrying capacity was nearly saturated prior to the development of this shopping center, it was incapable of accommodating a large-scale increase in shopping center-oriented traffic without creating serious congestion along the main street. Being located on this main street is not merely a problem in physical congestion; it is psychological as well. Automobile shoppers do not enjoy the prospect of having to drive along a street where noisy trucks and busses are constantly stopping or pulling out of line.

To try to improve accessibility, entrances have been provided into the shopping center from the rear and from one side street. However, most of the trading area feeds on to the main highway, and the auxiliary accessways actually offer little relief.

In contrast, Shopping Center D has been built only a mile away on a four-lane highway that runs parallel to the one described above. Accessibility to

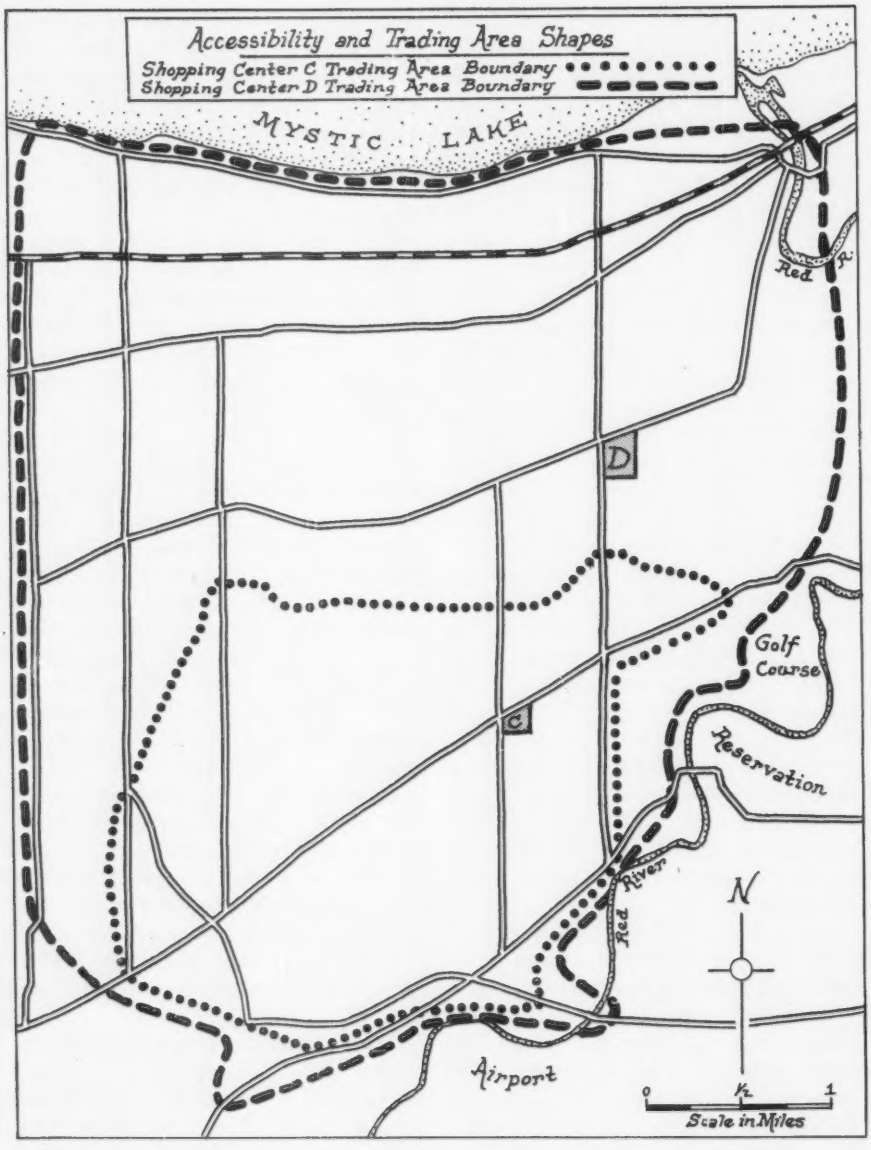

FIG. 2.

this center is good for two reasons: (1) the highway is not so heavily used by through traffic, and (2) a considerable portion of the trading area is oriented on the axis perpendicular to the main highway, and therefore uses the side street accessway, as illustrated in Figure 2.

One consideration occasionally overlooked is the manner in which acces-

sibility is affected by the amount of the traffic flow into a shopping center. For example, if there is customarily a long, continuous line of shopping center traffic taking a left turn to enter the site (cutting across traffic in the process), this in itself makes it easier for drivers to take the turn. A relatively small and discontinuous amount of customer traffic will encounter difficulty in cutting across the major line of traffic into a shopping center.

The peaks and valleys of traffic flow must also be considered in a discussion of accessibility. General "rush hour" traffic does not coincide with peak shopping hours, for those hours usually occur in the late mornings, mid-afternoons, and evenings. But, in some instances, the timing of factory shifts can adversely affect store shopping by increasing traffic congestion at critical shopping hours. So can traffic generated by special events during key hours and seasons, such as race track and stadium events. Some stores find their business spread fairly evenly throughout the week; some depend on Thursday, Friday, and Saturday for the bulk of their business; others find evening and Sunday hours important. Some stores are highly dependent on seasonal business. In the last analysis, then, both general traffic and store customer patterns must be compared to evaluate the role of traffic flow peaks and valleys in accessibility.

Visibility is an aspect of accessibility. If, for example, a store is located within the downtown, but is not visible from the main street, then its accessibility is not good. Store E was located as a downtown unit in a small town with a population of 6000. The site is at the end of a side street that leads into Main Street. Although this store has adequate off-street parking facilities and is only 50 yards from Main Street (which fronts the town's Common), it is not visible from the Common. Its accessibility, therefore, is not so good as that of Store F on Main Street, which is located 400 yards beyond the Common but is visible from the heart of the downtown.

Retail facilities that are located beyond the bend of a road and cannot be seen until traffic is directly in front of the entrance to the parking lot have poor accessibility. Low-lying sites subject to fog or smog also have poor accessibility. Such sites are especially disadvantageous on a high-speed highway that is heavily built up with strings of competing stores or shopping strips.

Insofar as a store requires advertising signs to draw highway traffic, and it is impossible to secure satisfactory locations for such signs, then the store's accessibility is decreased.

An example of the relationship of site accessibility to origin of customer traffic is illustrated by the following. Site G, northwest of a major rotary, contains a self-service department store and supermarket. Site H, on the southeast side, contains a similar complex (Fig. 3). This rotary is one of the most heavily trafficked in the entire metropolitan area, being the focus of four major arteries. Shoppers coming from the south do not have direct access to site G; they must instead take a half turn around the rotary, drive north along the highway for 0.5 miles, and then turn left against traffic into the parking lot. As an alternative they can take a three-quarter turn around the rotary and enter from the south via Site G's feeder road. In doing this they must cross two and three traffic lights respectively. Shoppers from the north and west who wish to approach Site H must drive half way around the rotary and enter by Site H's feeder road from the highway to the east. Shoppers from the east have difficult access to both

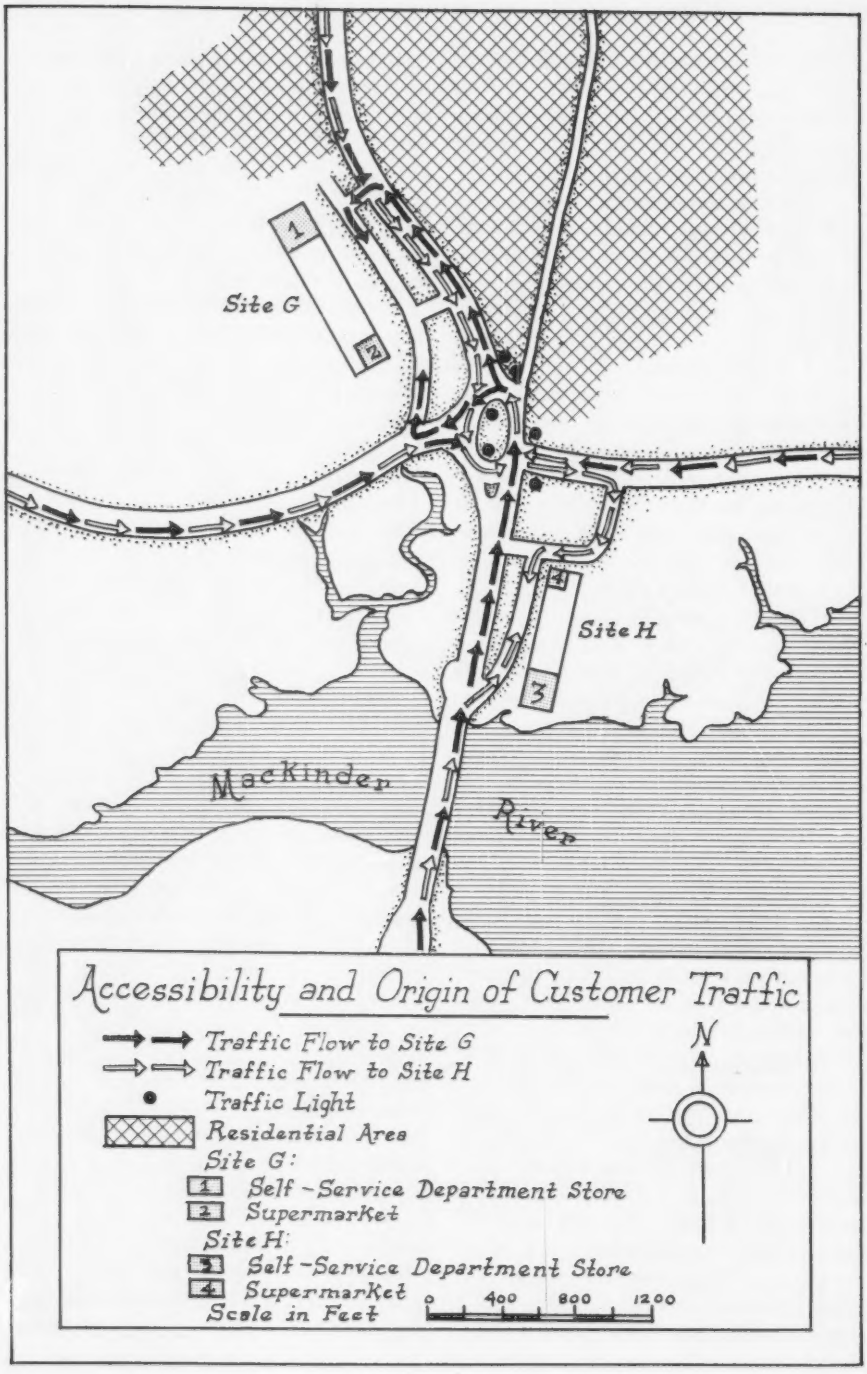
Site G
1
2
Site H
3
4
MacKinden
River
Accessibility and Origin of Customer Traffic
Traffic Flow to Site G
Traffic Flow to Site H
Traffic Light
Residential Area
Site G:
1 Self-Service Department Store
2 Supermarket
Site H:
3 Self-Service Department Store
4 Supermarket
Scale in Feet
0 400 800 1200
N

FIG. 3.

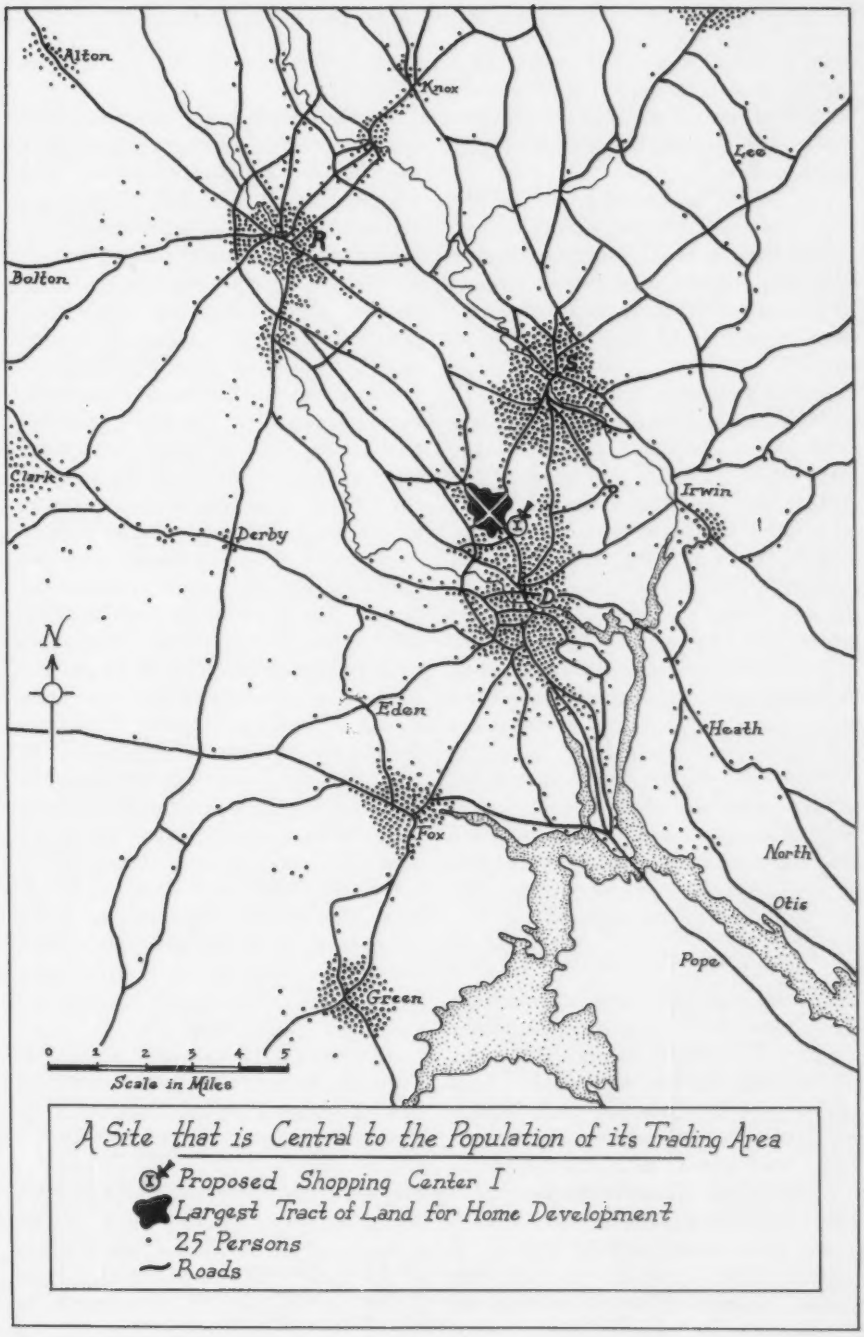
Alton
Knox
Lee
Bolton
Clark
Derby
Irwin
N
Eden
Heath
Fox
North
Otis
Pope
Green
0 1 2 3 4 5
Scale in Miles
A Site that is Central to the Population of its Trading Area
Proposed Shopping Center I
Largest Tract of Land for Home Development
25 Persons
Roads

FIG. 4.

sites, although the access to Site H is slightly poorer, because it involves doubling back around the rotary with three traffic lights to cross, as compared to two lights for Site G.

Analysis of the trading area of the two sites indicates the significance of accessibility to each. Of the customers who shop at these sites, Site G attracts 70 per cent of all those from the northwest, 60 per cent of those from the east, and 45 per cent of those from the south. Conversely, Site H obtains 55 per cent of the trade that originates from the south, 40 per cent of the trade from the east, and only 30 per cent of the trade from the northwest (cf. Figure 16 for the detailed distributional pattern of these customers). In evaluating the comparative merits of the two sites, the size of the market represented by the towns to the northwest and the competition therein has to be compared to the size of the market represented by the towns to the south and the competition there.

Therefore, while evaluating accessibility does not always readily lend itself to measurement techniques, there are, nevertheless, many opportunities to apply such techniques in the preliminary phase of site analysis.

POPULATION

The factor of population is paramount in evaluating store sites. Consideration is given to number, composition, density, growth, income, expenditures, and buying habits. These population characteristics, determined on the basis of census and survey data, can be translated into total market potential.

A detailed map of population distribution is the soundest base for population analysis. For example, the following map of the area that surrounds Proposed Shopping Center I shows that the stores would lie within the very center of the total population of the trading area (Fig. 4).

In the above case, new residential building trends indicate that most of the population growth would occur within towns D, S and R. The largest tracts of land available for home development lie immediately northeast and northwest of the site (whereas the nearest major shopping competition lies to the south). Figure 5 is based upon an analysis of the automobile customer flow of the nearest competitive department store. The analysis reveals that 23 per cent of its business comes from customers who have to pass the site of the proposed shopping center, and that another 32 per cent of its business comes from customers who live closer to the site under consideration than to the department store in which they presently trade. Town D is equally close to both sites, and only 22 per cent of the business comes from areas closer to the department store. Weighting the population distribution map by disposable income and then consumer expenditures further illustrates the strategic location of the site. Adjoining Town D's family incomes average $5000, Town R's $4900, and Town S $5200, while the surrounding outlying towns have income averages of $4200. Thus, the site lies at the center of the greatest concentration of consumer expenditures within the trading area.

In contrast, we can cite the case of Shopping Center J that has been built in a rapidly growing suburban area. Its owners feel that this center will not realize its full sales potential for another five years, but have built in anticipation of population and sales growth. Upon analysis of the population distribution of the trading area of Shopping Center J, the site is found to be eccentric to the center of population (Fig. 6). Of the 100,000 persons living within the

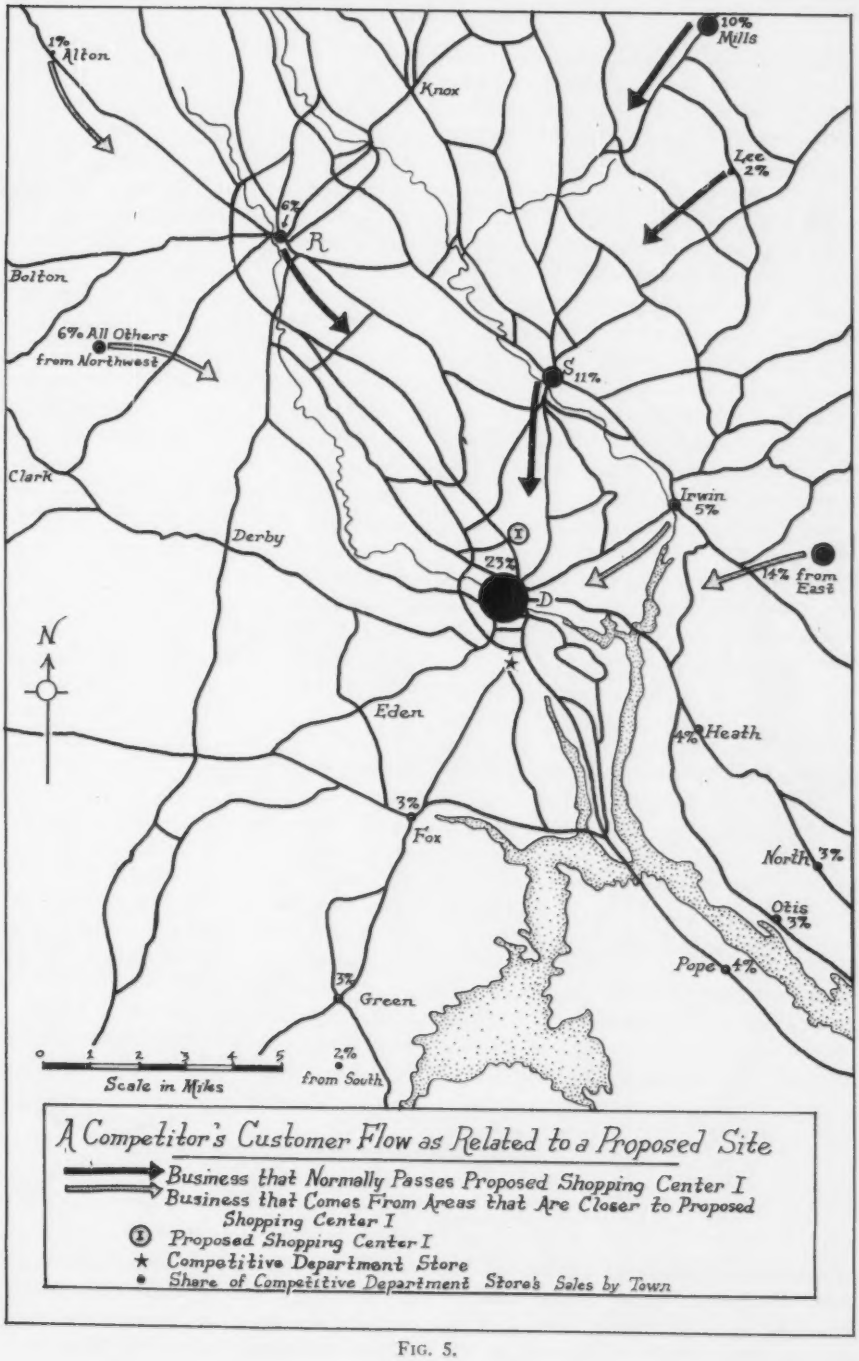
1% Alton
10% Mills
Knox
Lee 2%
6%
R
Bolton
6% All Others from Northwest
S 11%
Clark
Irwin 5%
Derby
I
23%
D
14% from East
N
Eden
4% Heath
3%
Fox
North 3%
Otis 3%
Pope 4%
3%
Green
0 1 2 3 4 5
Scale in Miles
2% from South
A Competitor's Customer Flow as Related to a Proposed Site
Business that Normally Passes Proposed Shopping Center I
Business that Comes From Areas that Are Closer to Proposed Shopping Center I
I Proposed Shopping Center I
★ Competitive Department Store
● Share of Competitive Department Stores Sales by Town

FIG. 5.

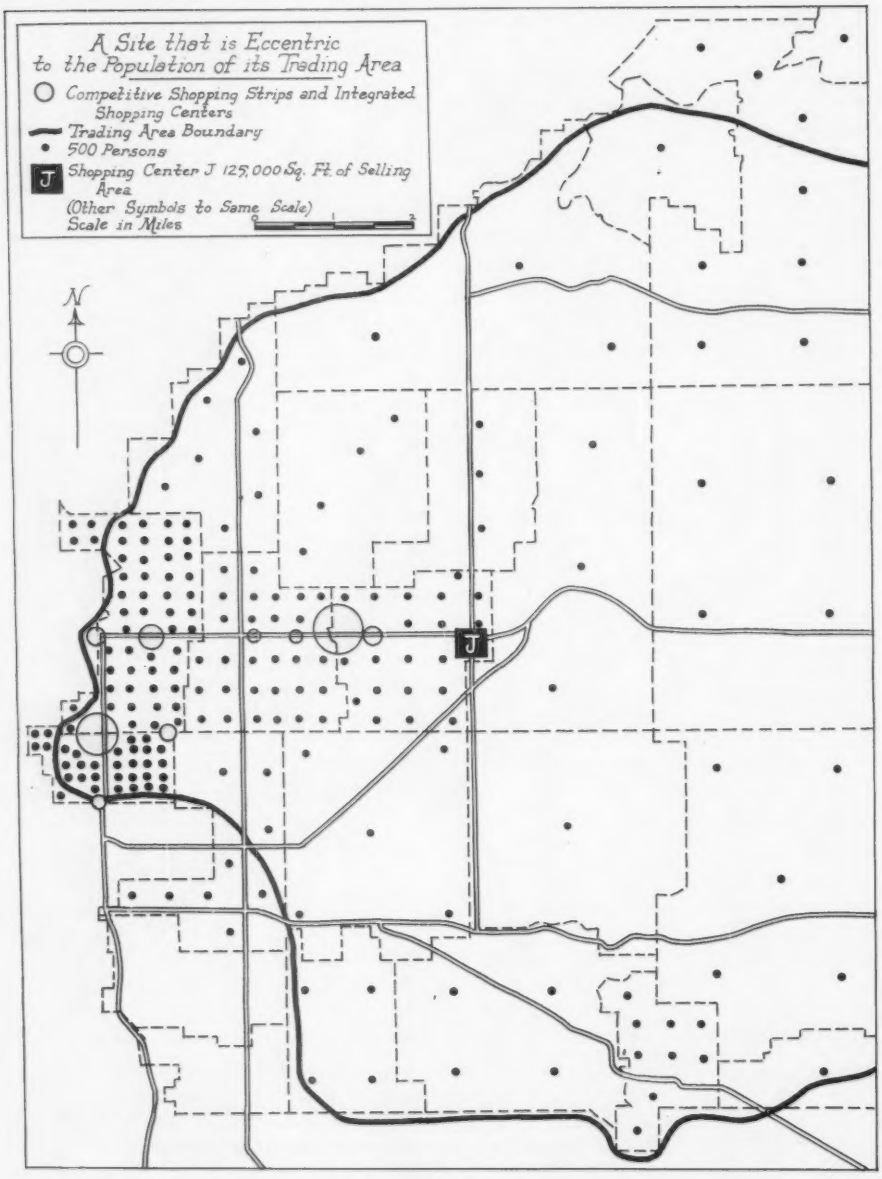
A Site that is Eccentric
to the Population of its Trading Area
Competitive Shopping Strips and Integrated Shopping Centers
Trading Area Boundary
500 Persons
J
Shopping Center J 125,000 Sq. Ft. of Selling Area
(Other Symbols to Same Scale)
Scale in Miles
N
J

FIG. 6.

trading area, 70 per cent live west of the site. Moreover, while vacant land to the west is rapidly being filled in with suburban subdivisions, growth to the east is limited by lot size restrictions of two acres, and by clay soils which prohibit the use of cesspools in areas of limited sewerage lines. The population

of the trading area is expected to increase by 33 per cent within five years. But this will not assure Shopping Center J of a commensurate growth in sales. Instead, several shopping strips that lie within four miles of the center to the west and a recently constructed large community shopping center only two miles to the west will attract most of the new, as well as compete for the current, business (Fig. 6).

By studying population distribution maps with an eye to area growth trends and highway developments, the hazard of being "shortstopped" by competitive facilities can be reduced. In this context, grid street patterns with no single, dominant intersection offer less opportunities for competition than street patterns that are dendritic. The latter create a number of key intersections than can attract competition. On the other hand, grid street patterns by no means serve as a guarantee against competitive locations.

COMPETITION

Competition is the aggregate of all retailing facilities which together share the total market potential. Thus, the competition of a retail enterprise comprises all retailing facilities which sell the same types of products.

Any attempt to quantify competition requires extensive field surveys. Where such elements as store size, parking, and age are mapped and classified, areas of current and future store concentrations can be discerned.

As an example, mapping competition in the case illustrated by Figure 7 serves to illustrate how the concentration of supermarkets along one major highway tends to contain the trading areas of the competitive supermarkets in the direction of this highway.

In analyzing competition it is necessary to relate this factor to the several other market factors that are taken into consideration in site evaluation. When the above competition map is superimposed upon a population distribution map, it becomes possible to discern that part of the general area which is overdeveloped with stores and that part which is underdeveloped. Furthermore, when the trading areas of the various competing stores are delineated, as in Figure 7, the relative merits of sites for proposed stores become clearer.

In the case under discussion, Site K was proposed for a supermarket as part of a planned community shopping center. Site L was proposed as a free-standing supermarket (Fig. 8). Upon analysis of the trading areas of competitive supermarkets within the trading area, we find that Site K is close to the center of the Primary Trading Areas[3] of two major competitors, and it is beyond the boundary of the third competitor. Under such circumstances, the proposed store's Primary Trading Area would become superimposed upon those of the other two, and competition among all three stores would be unusually severe. Proposed Store L, on the other hand, would have a Primary Trading Area that is overlapped only by the fringes of the Primary Trading Areas of two of its major competitors, and is beyond the boundary of the third competitor. Proposed Store L should therefore be able to penetrate more easily the market within its Primary Trading

[3] The term Primary Trading Area, as used in this paper, refers to that portion of the trading area which provides the greatest density of customers in relation to population. This is based upon findings that are tentative and subject to further validation. In metropolitan areas, generally, the Primary Trading Area for supermarkets provides 45 to 75 per cent of the customers, and a ratio of customers to population that is at least twice the customer-population ratio of adjoining portions of the trading area. The Secondary Trading Area includes 20 to 40 per cent of the customers and the Fringe Trading Area includes 5 to 15 per cent.

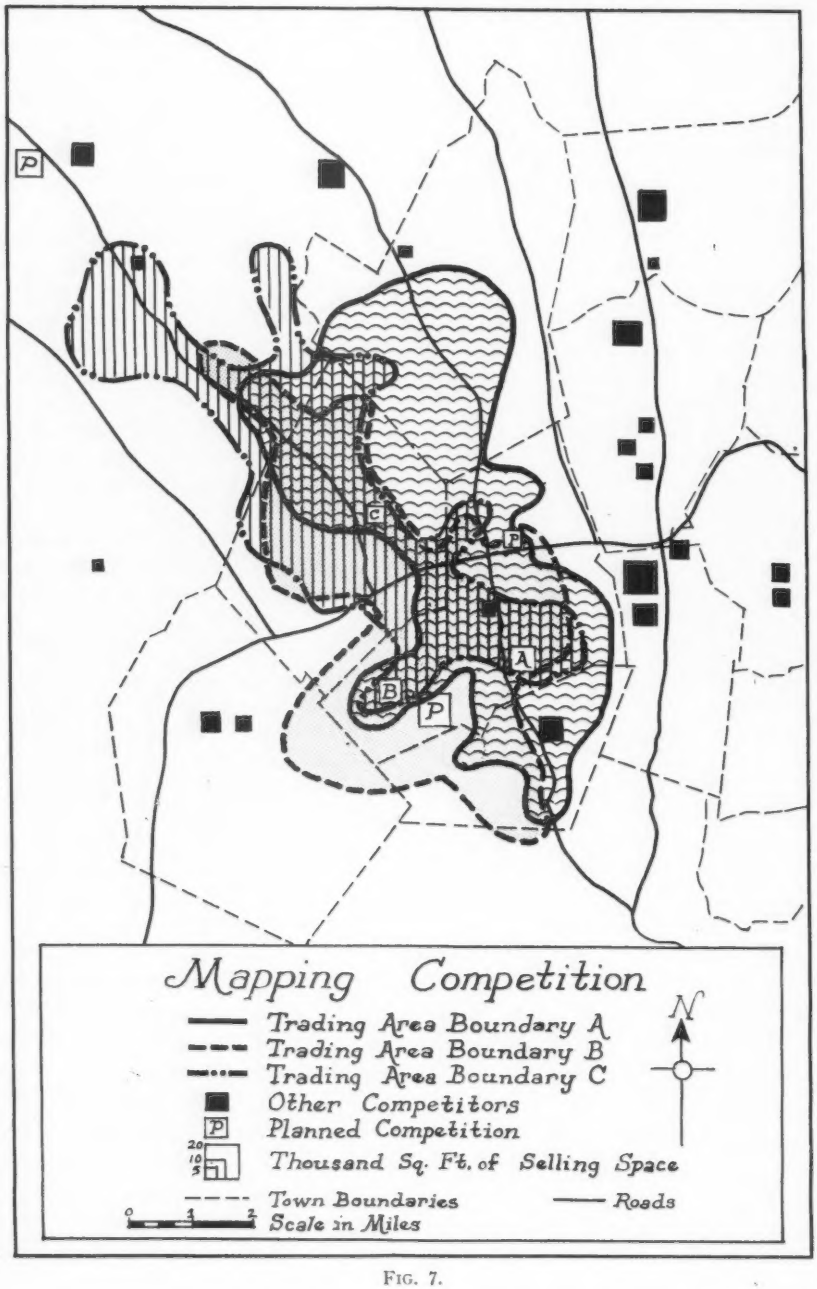
P
C
P
A
B
P
Mapping Competition
Trading Area Boundary A
Trading Area Boundary B
Trading Area Boundary C
Other Competitors
P
Planned Competition
20
10
5
Thousand Sq. Ft. of Selling Space
Town Boundaries
Roads
0
1
2
Scale in Miles
N

FIG. 7.

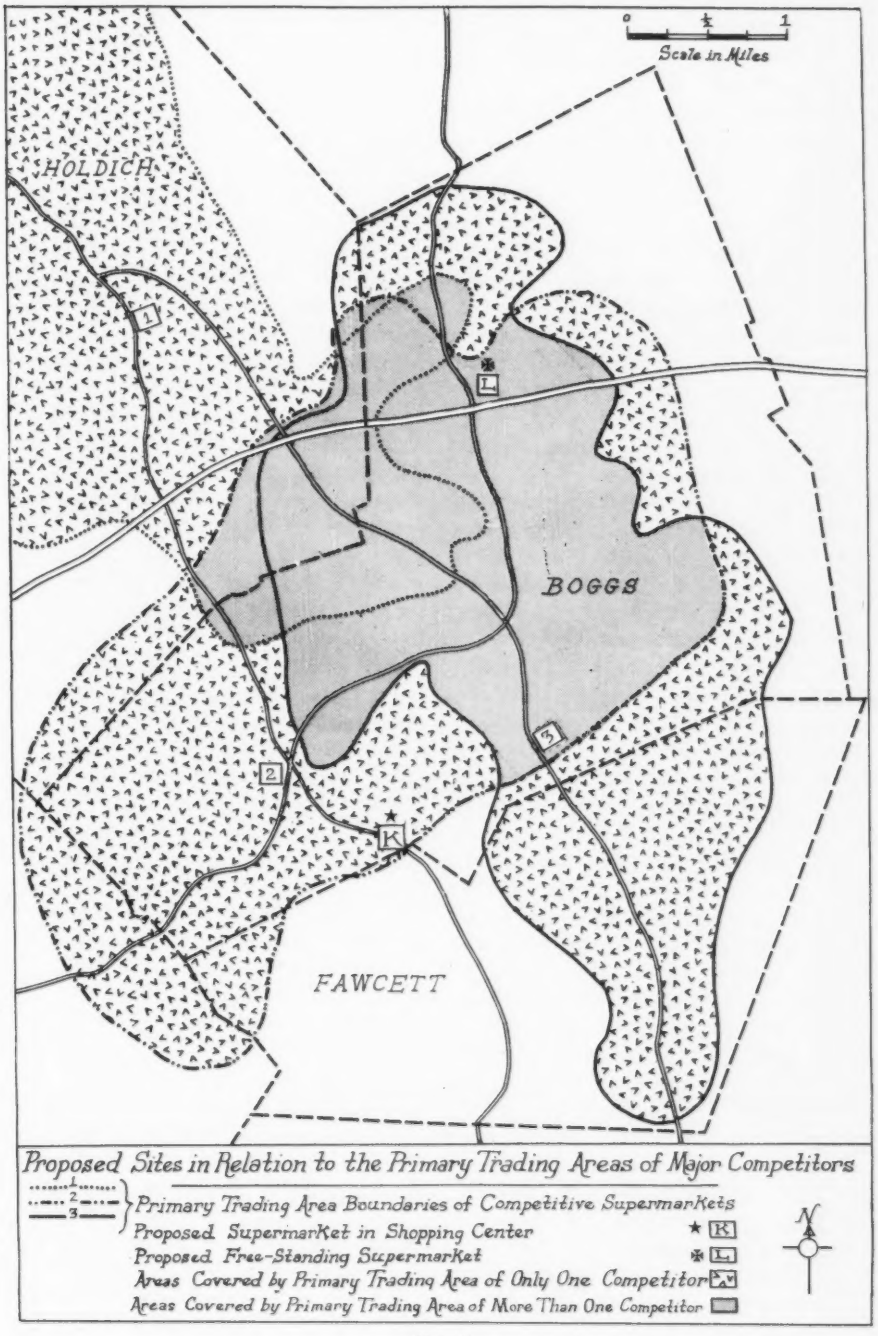
0 ½ 1
Scale in Miles
HOLDICH
BOGGS
FAWCETT
1
2
3
K
L
Proposed Sites in Relation to the Primary Trading Areas of Major Competitors
Primary Trading Area Boundaries of Competitive Supermarkets
Proposed Supermarket in Shopping Center
Proposed Free-Standing Supermarket
Areas Covered by Primary Trading Area of Only One Competitor
Areas Covered by Primary Trading Area of More Than One Competitor
N

FIG. 8.

Area than proposed Store K within its Primary Trading Area.

Analysis of the trading areas of competition can also be valuable in determining the general area for a new site. This case is illustrated in Figure 9. Town M (a New England variety "town") has a population of 5500 and lacks a modern supermarket. Nearly 60 per cent of Town M's food store expenditures are made out of town. Two sites are available—one at the eastern edge of the town, the other at the western edge.

It was determined by mapping the trading areas of supermarkets in adjoining communities that two-thirds of all food business escaping from Town M moves to the east (for approximately three miles) to supermarkets in a city with a population of 45,000. One-third of the escaping food business moves to the west, mostly to a city eight miles distant that has a population of 100,000. The site at the eastern edge of town will be in a position to intercept the greater part of the food business currently escaping from the town. Moreover, the eastern site is as well located as the site on the western edge of town to compete for the food business now being carried on by the small grocery stores strung along the town's main street. Therefore, the eastern site is deemed the more desirable of the two.

An analysis of competition without taking into consideration what possible measures competition would take would certainly be incomplete. This requires not only evaluations of potential sites, but also an insight into the different company policies with respect to store development and site selection patterns. For example, a food chain decided to build a second supermarket in a city with a population of 43,000. The company had one downtown store, but felt that this city, and its rural trading area (with the additional population of 37,000), was not being adequately tapped by the existing store. Two sites were available, one in the southwestern sector and one in the north (Fig. 10).

Initial analysis of population and income distribution indicated that the southwestern portion of the city was the most suitable for a new store, because the downtown store was not penetrating this area as deeply as it was the northwestern or eastern sectors of the city. Also, the southwestern sector has a population of 18,000 (the northern sector has 12,000 people and the eastern sector 13,000), and is readily accessible to the well-populated rural areas to the south and west. Finally it was felt that a store in the southwestern sector would be most advantageously located with reference to competition, because the largest competitor (a downtown store) was tapping the northern sector of the city quite heavily.

An alternative site in the northern sector was then presented to the company. This site was proposed as a shopping center by a highly successful developer of numerous community-sized centers. The developer had already signed up one supermarket (a chain with no previous units in the city), and, in keeping with his firm policy of refusing to grant an exclusive lease to one supermarket operator, desired a second supermarket.

The food chain that had been approached knew that the developer would have no difficulty in leasing a store to a competitor. It reasoned that its major downtown competitor, with a store in an old building and a parking lot across the street from the store (and doing a volume of about $5 per square foot of selling area—or nearly twice the national average), might welcome the opportunity to re-

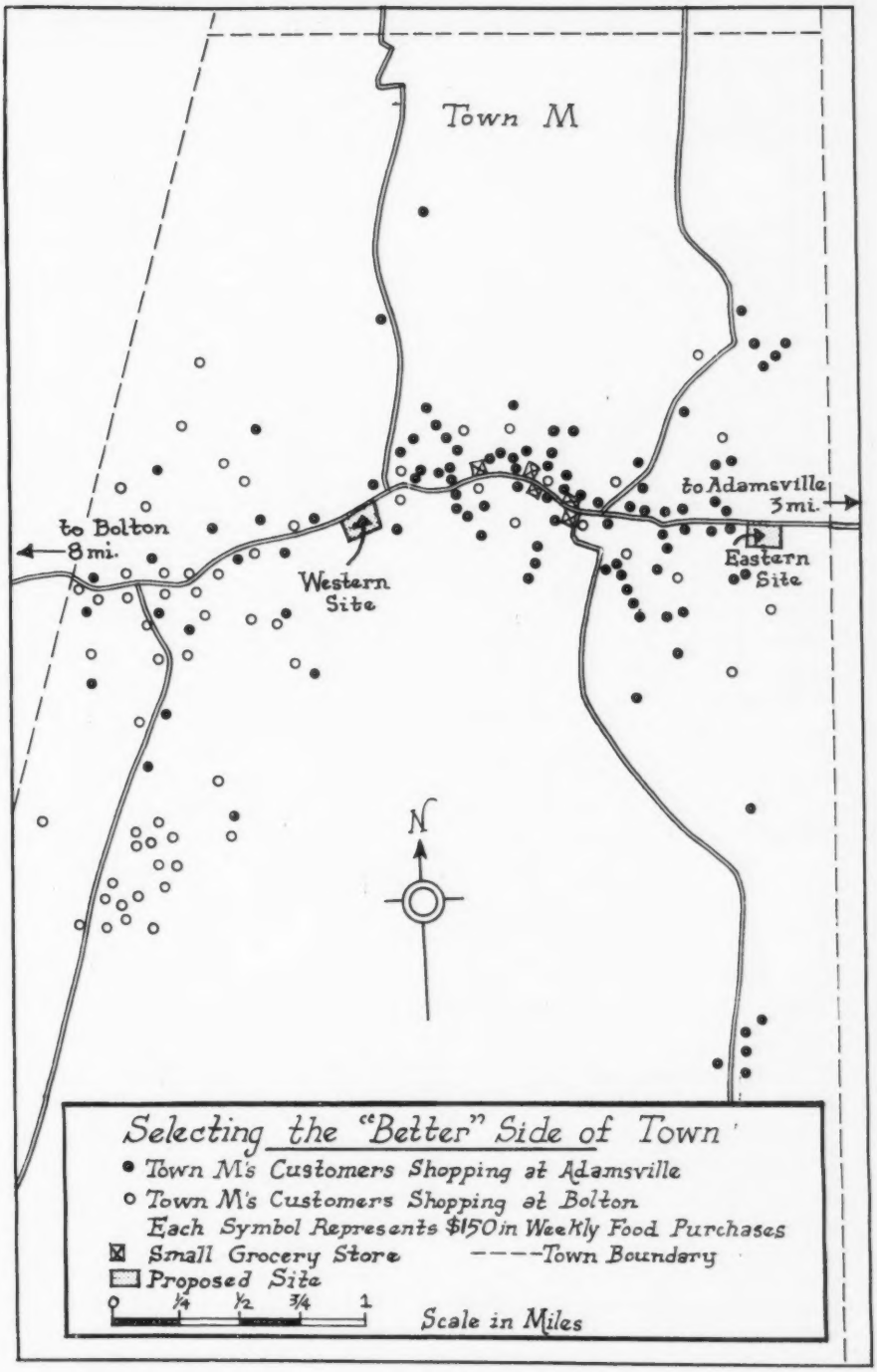
Town M
to Adamsville
3 mi.
to Bolton
8 mi.
Western
Site
Eastern
Site
N
Selecting the "Better" Side of Town
Town M's Customers Shopping at Adamsville
Town M's Customers Shopping at Bolton
Each Symbol Represents $150 in Weekly Food Purchases
Small Grocery Store
----Town Boundary
Proposed Site
0 ¼ ½ ¾ 1
Scale in Miles

FIG. 9.

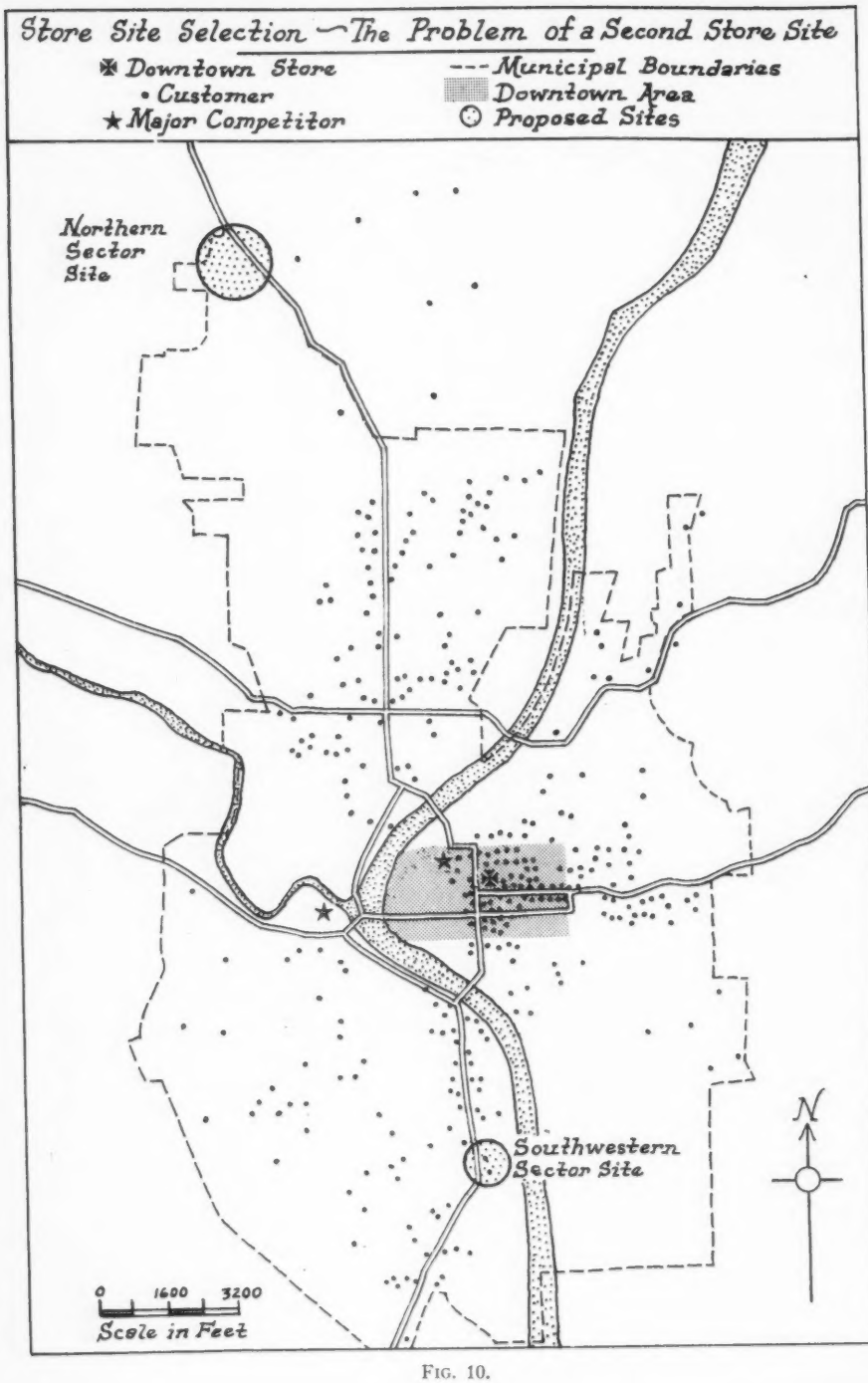
Store Site Selection — The Problem of a Second Store Site
Downtown Store
Customer
Major Competitor
Municipal Boundaries
Downtown Area
Proposed Sites
Northern Sector Site
Southwestern Sector Site
N
0 1600 3200
Scale in Feet

FIG. 10.

duce the load on its existing store. Another chain not yet in the city and several independents were also interested in the shopping center location. The decision was therefore made to build the new supermarket in the proposed shopping center, despite the various advantages that a freestanding store in the southwestern sector had to offer. In this instance, the selection of the site was geared to an anticipation of what the competition might do. From the long-range point of view, moreover, the company might have considered closing its downtown store and building one in the south as well.

ECONOMIC STABILITY

Economic stability of an area can be generally evaluated, but not predicted with certainty. A useful initial step is the classification of areas by functional types, such as residential, manufacturing, farming, trading, transportational, recreational, educational, defense, or diversified. Among the indicators of trends in area functions are such data as relate to the value added by manufacturing, agricultural production, farm size, residential land values, construction activities, the extent of utilities and cost of bringing these in, and the location associations between primary industries and the users of their products.

High value added by manufacturing often indicates high employee incomes, but more limited job opportunities. As the trend to increasing efficiency through automation becomes stronger, productivity increases without adding to the labor force. The result is that some areas may enjoy industrial prosperity, while a portion of the labor force cannot find employment. Marginal farming areas are shrinking, and the trend to decrease federal farm subsidies continues to depopulate those rural areas whose near-by towns lack a basis for manufacturing. In certain industries, however, the availability of a marginal farming class to provide low cost labor can prove a strong industry location incentive. This is the case for less highly mechanized manufacturing activities, like apparel and shoes.

Residential land values and building activities are indicators that should always be weighed together with such factors as total land suitable for development, transportation systems, and area support bases. The extent of utility lines can be a guide to the directional growth of communities. Costs of utilities can be used in making industrial development forecasts.

New primary metal industries along Delaware Bay have attracted numerous fabricators to them. Sometimes the process is reversed, as the primary industries follow the secondary ones. For example, the shift of shoe manufacturing plants from eastern Massachusetts to the coast of Maine and its associated river valleys has begun to attract tanneries to those areas.

Another significant economic indicator relates to the employment of women. In certain manufacturing industries, like electronics, apparel, and shoes, women constitute nearly half the labor force. Generally, half of the working women are married. In such areas, average family incomes will be higher than in areas where married women hold employment in service trades.

To analyze the industrial structure of a city, it is helpful to distinguish between those industries that produce essentially for the city's inhabitants and those that produce for a market outside the city. Industries that serve the local market are the service industries (retailing, wholesaling, transportation, etc.) and such manufacturing industries as food processing, construction, and print-

ing. These are referred to as *non-basic* or *city-serving* industries.[4]

Industries that produce for the regional, national, or international market are referred to as *basic* or *city-forming* industries. They can be easily discerned, because they are the industries that are scattered so as to take advantage of specialized location conditions. Such industries range from the steel or automotive industries to defense force installations and educational institutions. But all industries that are geared to the export of their products also supply their city or metropolitan markets. The stability of basic industries, therefore, relates partly to the breadth of the local market. It also relates to national and international competitive conditions. For example, many cities in the Northeast have benefited from the unprecedented growth of the electronics industry. But now that international competition from Western Europe and Japan is beginning to make inroads upon the American market, as well as to fulfill domestic needs, the stability and growth of sectors of this industry cannot be taken for granted.

Even completely accurate assessments of the economic prospects of an area cannot always indicate the desirability of such areas for store sites. Instead, they must be weighed against shopping habits and the quality of available stores.

As an example, poor economic prospects for an area may discourage the opening of new department stores, automobile distributorships, or integrated shopping centers, but not of free-standing supermarkets. In 1958, food store sales increased by 6 per cent in the United States to a total of $52 billion, despite the economic recession. However, sales of department store type goods, homes, and automobiles did not experience this increase. This would indicate that the amount of money available for food store purchases is more of a constant. Welfare benefits assure a minimum amount of money for depressed areas, and consumers seem to consider the maintaining of a high rate of food consumption as an absolute necessity.

Obviously, a heavy loss of population from an area would hurt food stores, as it would other types of stores. But in weighing the economic base of some communities, it is important to measure the weakness of the competition against the prospects of economic instability. In some instances, it will be discovered that there is a dearth of modern supermarkets in depressed towns or older sections of central cities—so much so that these areas may prove quite attractive to supermarket developments.

TRADING AREAS

If we were selecting a single store on a small island of a few square miles, we might expect the entire island to be a trading area. Such "closed" trading areas are infrequently found. They are most likely to occur in rural areas. The definition of the boundary, in such instances, can be based upon the general trading area of the community (to be determined from such data as newspaper circulation lists, bank check clearances, and shopper interviews).

It is possible to apply gravitational model formulae to such situations. For example, an adaptation of "Reilly's Principle of Retail Gravitation" holds that a retail district in competition with another retail district will attract customers from a rural area in direct proportion to the size of its retail facilities and

[4] For a concise discussion of this subject, see Gunner Alexandersson: "The Industrial Structure of American Cities," Lincoln, Nebr., 1956.

in inverse proportion to the square of the driving-time-distance.[5]

In estimating the extent of the food store trading area of Town N, the following fact sheet was used: Town N has 25,000 square feet of food store selling area; Town O has 50,000 square feet Town P has 25,000 square feet; Town Q; has 75,000 square feet. The time-distance from Town N to Town O is 70 minutes (7 units), from Town N to Town P 23 minutes (2.3 units), from Town N to Town Q 60 minutes (6 units). The formula that was employed to demine the breaking point in trade between Town N and the surrounding three towns was:

$$(1)\quad x \text{ equals } \frac{\text{total driving time from Town N to Town O}}{1 + \sqrt{\frac{\text{sales area of Town O}}{\text{sales area of Town N}}}}$$

In this case x represents the driving time outward from Town N.

(2) Thus

$$x \text{ equals } \frac{7 \text{ driving-time units}}{1 + \sqrt{\frac{50{,}000}{25{,}000}}}$$

$$(3)\quad x \text{ equals } \frac{7}{1 + \sqrt{\frac{2}{1}}}$$

$$(4)\quad x \text{ equals } \frac{7}{1 + 1.4}$$

$$(5)\quad x \text{ equals } \frac{7}{2.4}$$

$$(6)\quad x \text{ equals } 2.9$$

The boundary line between Town N and Town O is therefore 2.9 units or 29 minutes from Town N (Fig. 11). By the same formula, the line extends 11 minutes in the direction of Town P and 21 minutes in the direction of Town Q. This formula simply affixes the point at which the boundary is to be drawn—that is the breaking point where trade is evenly divided.

In metropolitan areas, however, it is extremely difficult to employ gravitational models. This is because competition is to be found in so many different directions at so many different scales. Also, driving-time distinctions may be only a matter of moments.

Under these circumstances, the boundaries of trading areas for specific stores can be arrived at empirically. If a sufficient number of stores similar in location to the one proposed can be found, then the trading areas of these stores can be mapped. This is done by determining customer address from store interviews or automobile registrations. The trading area boundary of the proposed store can then be drawn, taking into account the local situation insofar as land use patterns, population distribution, and competition are concerned.

In the instance illustrated by Figure 12, both the Primary and Secondary Trading Area Boundaries of proposed Supermarket L (cited previously) were drawn up by relating driving-time, population density, and the distribution of competitive facilities to the trading areas of operating stores in similar locations. The shape of the Primary Trading Area is related quite closely to the distance between the proposed store and its competition and to population density. To the south, the line is bent inward by strong competition and by congested driving conditions. To the west, it reaches out to the competition. To the north and east, the line extends half way to the nearest competitor. To evaluate the significance of this boundary, the Primary Trading Area boundaries of the major competitors (cf. Figure 8) were plotted on Figure 12. The overlap of these into the Primary Trading Area of the proposed store was

[5] The principle was first stated in William Reilly: "Methods for the Study of Retail Relationships," *Bureau of Business Research, Monograph 4*, University of Texas, Austin, 1929. (Reprinted, Austin, 1959.) Examples of its application are presented in Isadore Wise: "Retail Trade Analysis," University of Wisconsin, Madison, 1954.

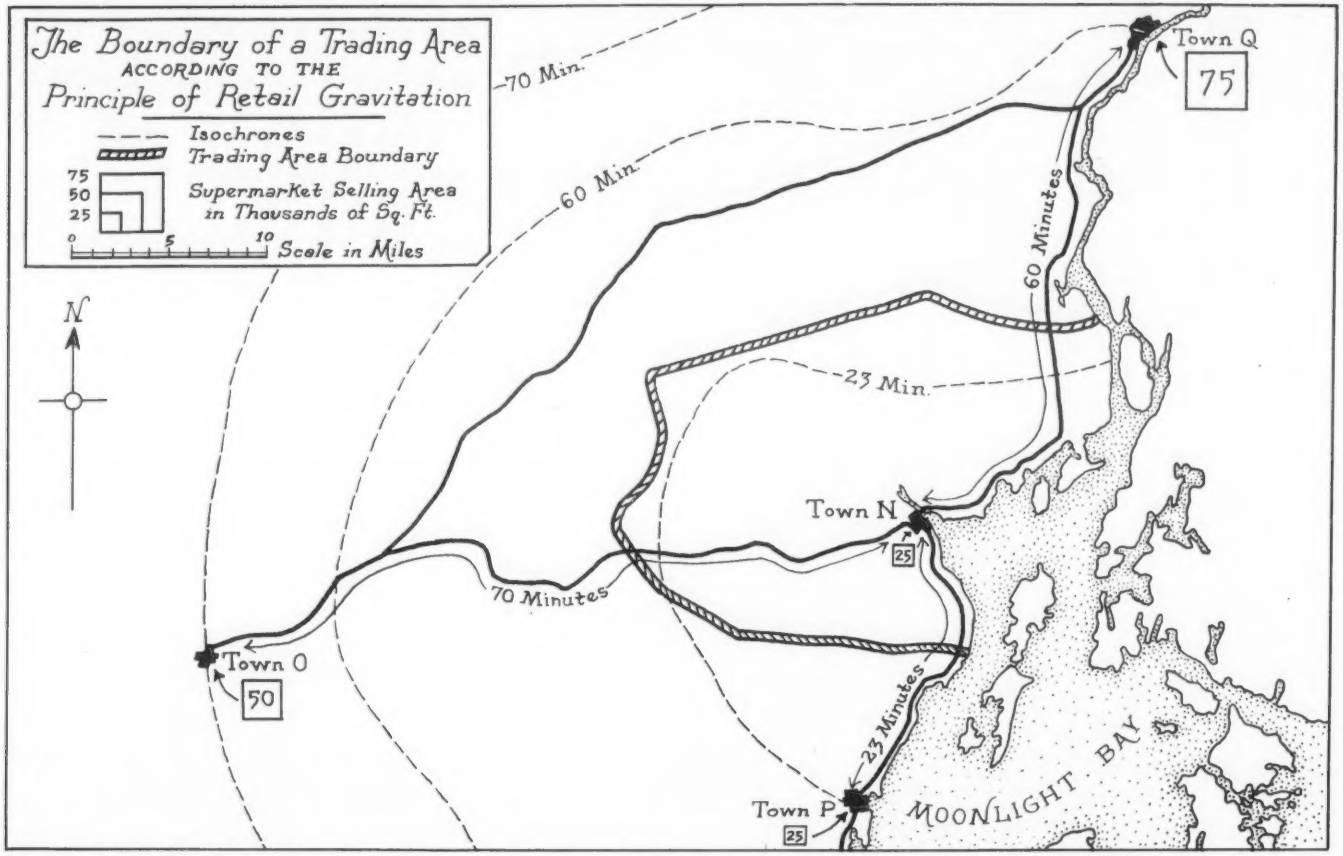
The Boundary of a Trading Area
ACCORDING TO THE
Principle of Retail Gravitation
Isochrones
Trading Area Boundary
75
50
25
Supermarket Selling Area in Thousands of Sq. Ft.
0
5
10
Scale in Miles
N
70 Min.
60 Min.
60 Minutes
23 Min.
Town Q
75
Town N
25
70 Minutes
Town O
50
23 Minutes
Town P
25
MOONLIGHT BAY

FIG. 11.

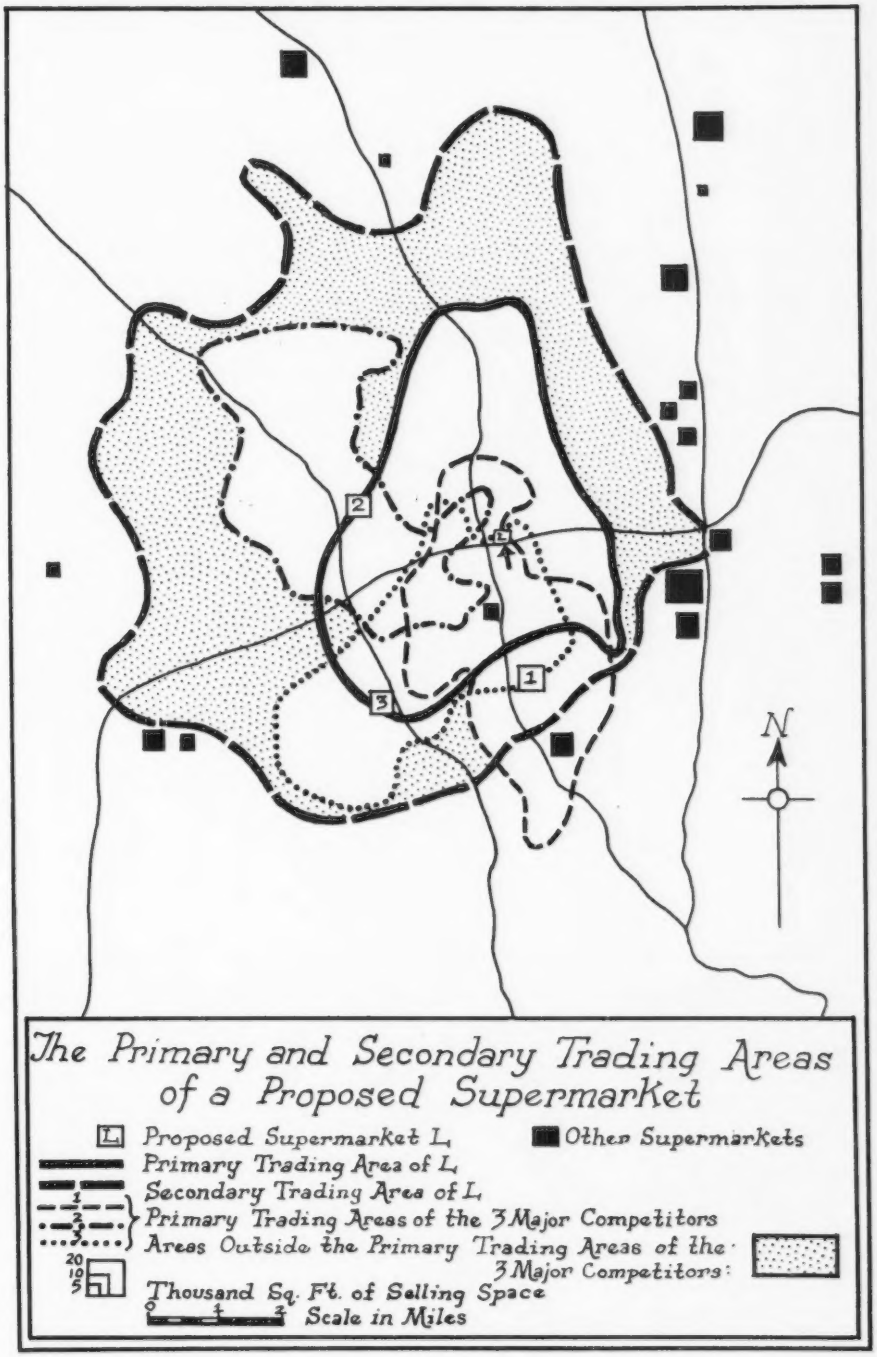
The Primary and Secondary Trading Areas of a Proposed Supermarket
L Proposed Supermarket L
Other Supermarkets
Primary Trading Area of L
Secondary Trading Area of L
1
2
3
Primary Trading Areas of the 3 Major Competitors
Areas Outside the Primary Trading Areas of the 3 Major Competitors
20
10
5
Thousand Sq. Ft. of Selling Space
0
1
2
Scale in Miles
N

FIG. 12.

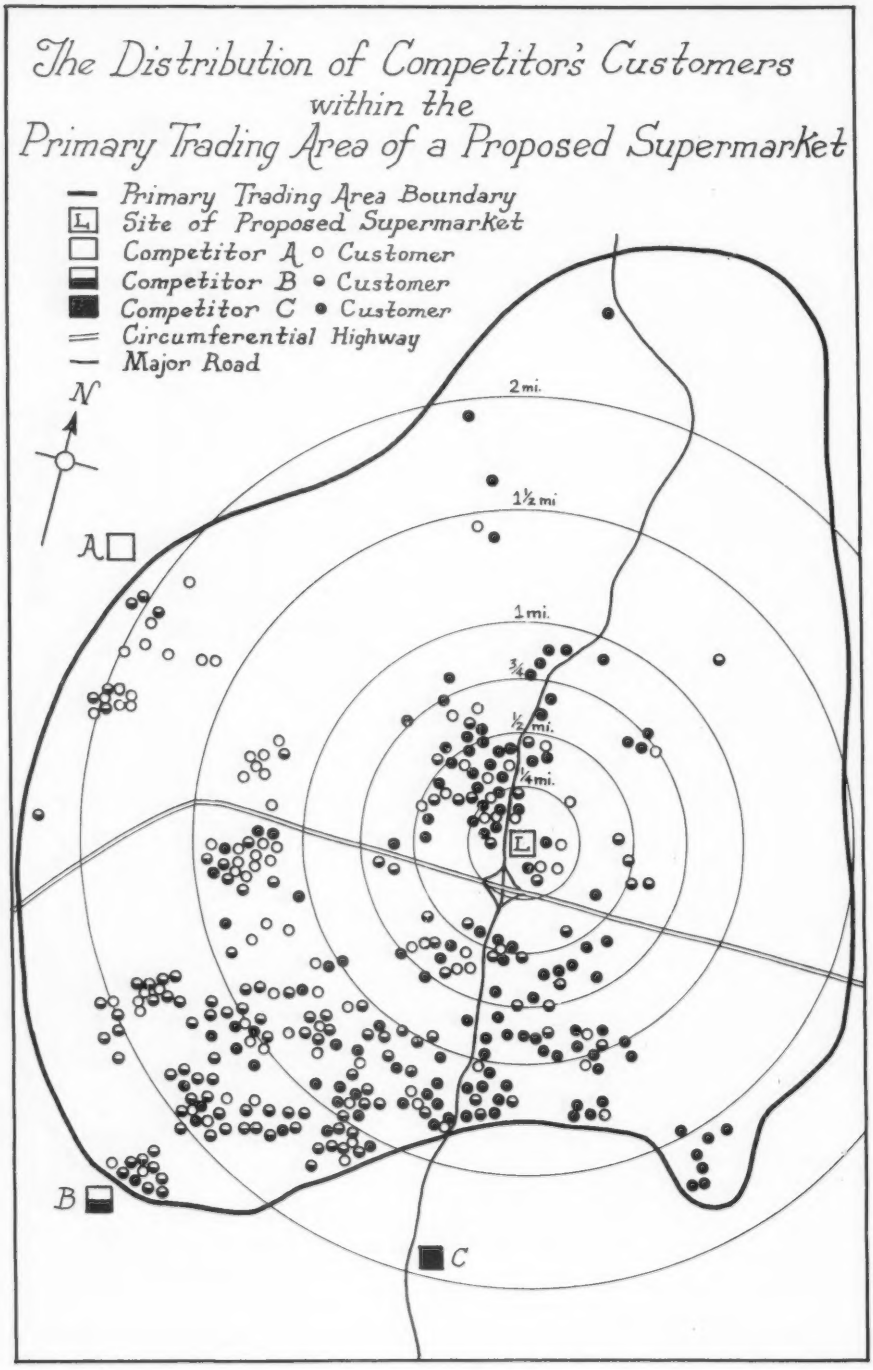
The Distribution of Competitor's Customers
within the
Primary Trading Area of a Proposed Supermarket
Primary Trading Area Boundary
Site of Proposed Supermarket
Competitor A ○ Customer
Competitor B ● Customer
Competitor C ● Customer
Circumferential Highway
Major Road
N
2 mi.
1½ mi
1 mi.
¾
½ mi.
¼ mi.
A
B
C

FIG. 13.

TABLE I

COMPETITORS' COMBINED SHARE OF THE FOOD MARKET FROM WITHIN THE PRIMARY TRADING AREA OF THE PROPOSED STORE

Mileage from location of proposed store	*0–¼*	*¼–½*	*½–¾*	*¾–1*	*1–1½*	*1½–2*	*2–3*	*Total*
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
.....	50	43	26	37	23	29	18	27

not sufficiently critical to discourage the building of this store.

PENETRATION OF THE TRADING AREA

As important as the establishment of trading area boundaries is the evaluation of a store's prospects for penetrating this trading area and capturing a satisfactory share of the market.

To examine the possible impact of the competition upon the above proposed store's Primary Trading Area, the addresses of a representative sampling of the competitions' automobile customers were plotted. All told, 1400 license plates were analyzed. Of these, 339 fell within Store L's Primary Trading Area and were plotted on the map (Fig. 13).

It was found that the three competitive supermarkets obtain only 27 per cent of the food business available within the proposed store's Primary Trading Area.

In view of the competition's relatively limited share of this market, it was felt that the proposed supermarket could hope to obtain its goal—20 per cent of the Primary Trading Area business, and 4 per cent of the Secondary Trading Area business. Within the quarter and one-half mile zones, considerable business will have to be captured from these competitors, but the store will be advantageously located to do so, since the other stores are not close by. Beyond the one-half mile zone, the bulk of the food business is being handled by small groceries or is escaping from the area. It was, therefore, considered possible for the proposed supermarket to capture the necessary business because it would not be running into headlong competition.

In certain instances, the penetration that one store makes of a given trading area will be completely different from that of a similar type of store operating within the identical trading area. This reflects the fact that the personality of the store—its physical facilities, merchandising, and promotional skill—affects the potential business obtained. Thus two supermarkets located within a shopping center might have similar trading area boundaries but substantially different drawing power and penetration capabilities.

An example would be that of Super-

TABLE II

VARYING CUSTOMER DRAWING POWER OF SIMILAR STORES

Mileage zones	*0–1*	*1–2*	*2–3*	*3–4*	*4–5*	*5–12*	*Rural routes ½–9*	*Total*
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Customer drawing power of Supermarket R	18.6	28.9	11.6	9.4	2.1	17.7	11.7	100
Customer drawing power of Supermarket S	14.5	27.6	10.5	12.4	3.1	23.4	8.5	100

markets R and S located within an integrated community shopping center that lies on the fringe of a small city and taps an extensive rural area (Table II). The drawing power, or percentage of customers from various parts of the trading area, differs for each store.

The drawing power of Supermarket R is more intensive. Fifty-nine per cent of its customers come from within three miles (less rural route areas). Only 52 per cent of Supermarket S's customers come from within three miles. The extensive nature of Supermarket S's drawing power is most noticeable in the 5–12 mile zone.

In addition to the distinction in drawing power, there is a distinction in penetration of the market. As a whole, Supermarket R penetrates the trading area more deeply. Its average weekly per capita sales amount to $0.32 (derived by dividing the weekly sales volume by the total population within the trading area). The average weekly per capita sales of Supermarket S amount to $0.25. But the penetration of the two stores, when broken down according to city and rural areas, is as shown in Table III.[6]

Further analysis shows that in the small rural villages and towns at the farthest edge of the trading area, Supermarket S has higher per capita sales than Supermarket R. One explanation of this difference in penetration power is that Supermarket S belongs to a chain that has had small stores throughout the rural area for some time. In penetrating these areas with modern supermarkets, it has an advantage over its competitors. Supermarket R, on the other hand, belongs to an aggressive chain that has just entered the area. Its merchandizing and promotion policies are particularly geared to the urban market.

TABLE III

VARYING WEEKLY PER CAPITA SALES OF SIMILAR STORES

Area	*City*	*Rural*	*Combined*
Supermarket R.....	$0.42	$0.20	$0.32
Supermarket S.....	0.32	0.17	0.25

[6] For a discussion of the techniques of drawing power and penetration analysis, see William Applebaum and Richard F. Spears: "How to Measure a Trading Area," *Chain Store Age*, January, 1951, and Howard L. Green and Bart J. Epstein: "Store Location Analysis," *Marketing Research in Action*, Studies in Business Policy, No. 84, National Industrial Conference Board, Inc., 1957.

The shopping center in which these two stores are located lacks a department store. If such a store should be added, Supermarket S would stand to benefit to a relatively greater degree than Supermarket R. This is because an extension of the trading area boundary of the shopping center would probably extend the trading area boundary of the supermarkets. Such an extension would tap still farther the rural areas where Supermarket S has good customer acceptance.

Knowing the personality of a store, as in the above case, is indispensable in forecasting sales, because this knowledge can be related to the potential penetration of the trading area. The best guide for evaluating this personality lies in the operating performance of existing stores owned by the same company in similar types of locations.

STORE SIZE AND STORE FUNCTION

If a site is to be occupied by only one store, then that store must exert all the pulling power to draw customers. If such a store is considerably larger than any of its competitors and carries many different lines of goods, then its trading area will be more extensive than the trading area of a smaller store at the same or at a near-by site.

The question as to the interrelationship between store site and store func-

tion is fundamental. Both the site and the function of a store determine its trading area.

If a store's functions are essentially the same as those of its competitors, then the shape of its trading area will relate directly to the type of location. An example is that of previously cited Supermarkets A and B, located within half a mile of one another on a main highway on the fringes of town (Fig. 1). Store B, with 20,000 square feet of selling area, is two and a half times the size of Store A and has a sales volume that is four times as great. However, the function of the two stores, as expressed by the types of goods handled, are similar. The Primary Trading Areas of these two stores, therefore, are essentially the same (making allowance for the fact that the stores are half a mile apart) (Fig. 14).

On the other hand, if a full-scale, 250,000 square foot department store is placed on a site, it will have a larger trading area than a junior department store on the same site. This is because the large department store's functions in the sales of appliances, furniture, apparel, etc., are far broader than those of the junior department store. Similarly, an 80,000 square foot supermarket carrying also a broad variety of non-food items will have a more extensive trading area than the conventional 12,000 square foot supermarket. But the degree to which the very large store will extend the trading area boundaries will be influenced by the site. Placing an 80,000 square foot supermarket on a highway will result in a large trading area. Placing that same supermarket in a secondary business district, with heavy traffic friction and peripheral competition, will cut down the extent of the trading area. In the latter case, store function and size will be out of balance with store site.

SHOPPING CENTERS

What applies to individual stores applies to groups of stores as well. The following is an example of a shopping center whose size is not in balance with the site. Shopping Center C (shown in Figure 2) is located on a 12-acre plot in a densely settled, suburban area. It has 29 retail stores, with 100,000 square feet of gross floor area and 75,000 square feet of store selling area. The leading stores are a junior department store and two supermarkets.

Although the developers conceived of this as a community size shopping center, the trading area of this center and its leading stores resembles that of a neighborhood type of trading area. Eighty per cent of the supermarket customers live within three miles, and three-fourths of the department store customers live within this zone.

The spread of customers shown in Figure 15 represents the drawing power of the center's five leading stores. The Primary Trading Area boundary lies within the six-minute isochronal zone, and most of the Secondary Trading Area lies within the eight-minute isochronal zone.

Perhaps the fundamental fault with this center is that it was not large enough, when built, to dominate the rapidly growing population that surrounds it. Within three miles, the population is 65,000. From three to six miles, the population totals another 200,000. To the west, in particular, the growth is rapid, amounting to annual increases in population of 6 per cent in some of the suburbs.

Because of this large and rapidly growing population, regional Shopping Center D was constructed one and a half miles to the north and another is being constructed four miles to the west (Fig. 15). In the face of this com-

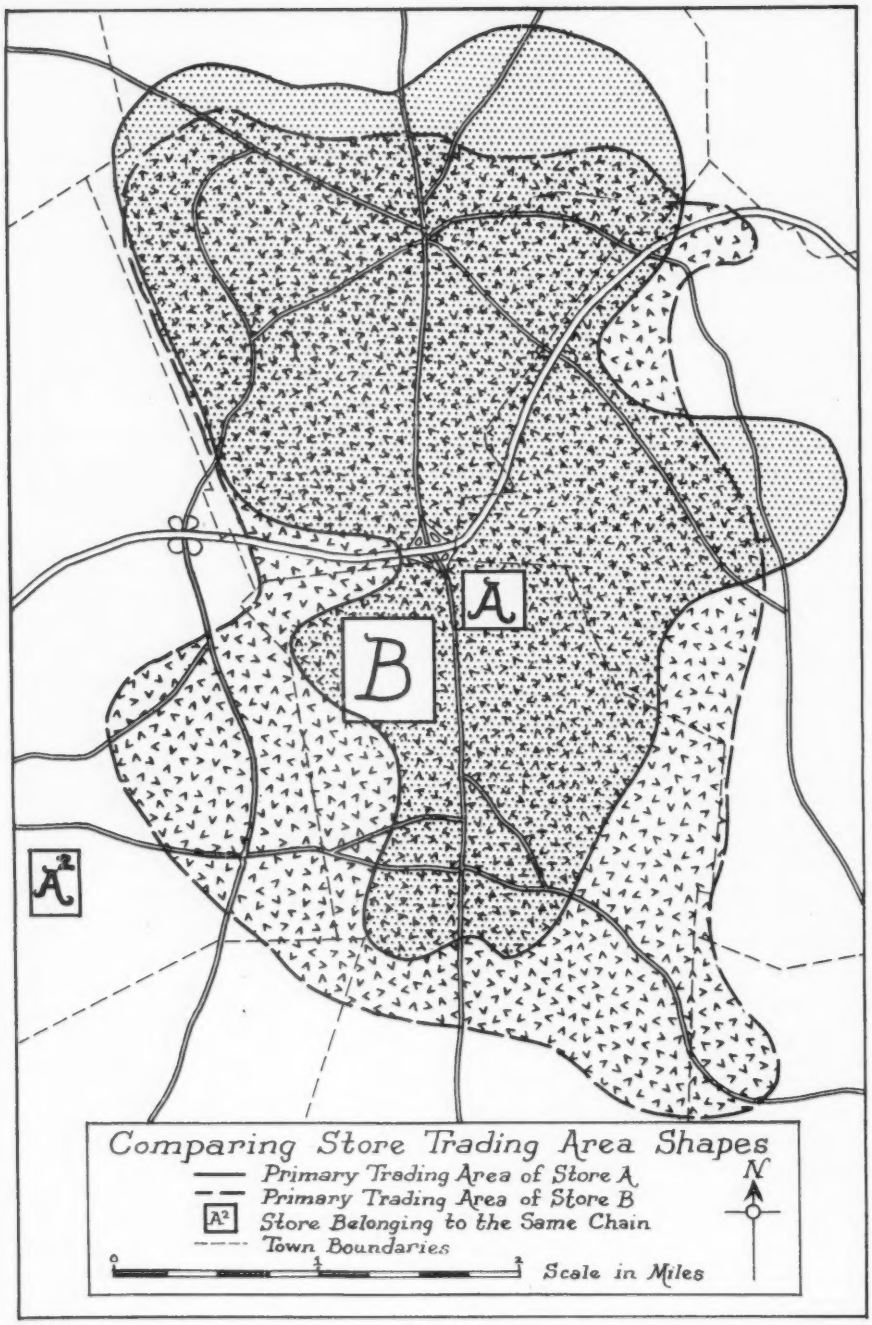
A
B
A²
Comparing Store Trading Area Shapes
Primary Trading Area of Store A
Primary Trading Area of Store B
A² Store Belonging to the Same Chain
Town Boundaries
N
0
1
2
Scale in Miles

FIG. 14.

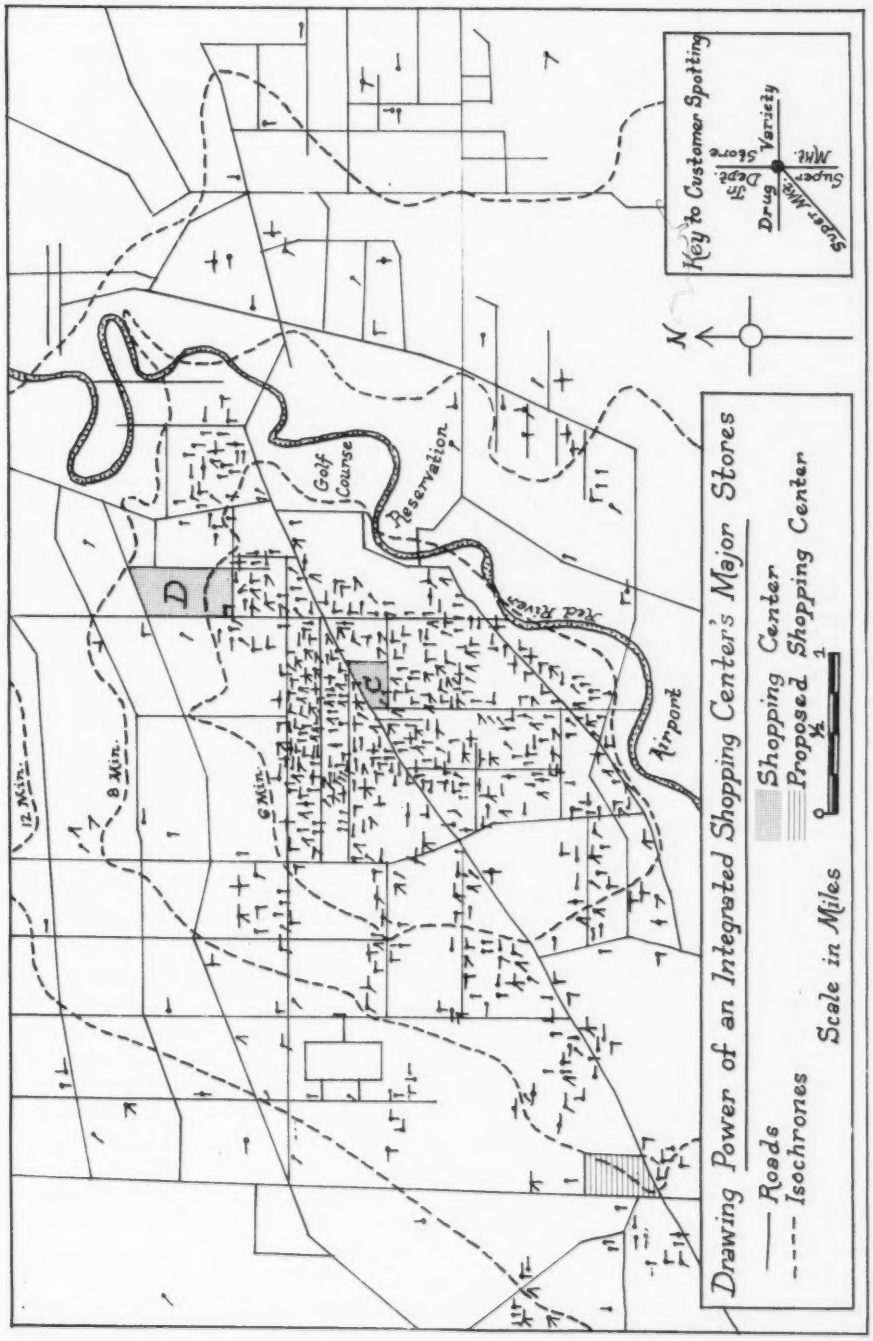
Drawing Power of an Integrated Shopping Center's Major Stores
Roads
Isochrones
Shopping Center
Proposed Shopping Center
Scale in Miles
Key to Customer Spotting
Drug
Variety
Super Mkt.
Dept. Store
Golf Course
Reservation
Red River
Airport
12 Min.
8 Min.
6 Min.
D
C
N

FIG. 15.

TABLE IV

DRAWING POWER BREAKDOWN OF SHOPPING CENTER C

Mileage zone	*0–¼*	*¼–½*	*½–¾*	*¾–1*	*1–1½*	*1½–2*	*2–2½*	*2½–3*	*3–6*	*Over 6*	*Total*
Total center customers interviewed	79	244	201	123	197	151	80	66	281	48	1,470
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Supermarket 1	7.5	17.7	13.1	7.8	14.8	8.3	4.7	5.7	17.1	3.3	100
Supermarket 2	6.2	19.3	12.7	8.2	15.4	11.1	5.2	4.1	16.4	1.4	100
Super drug	6.4	18.7	15.2	8.0	12.5	8.3	5.6	4.8	16.5	4.0	100
Variety	6.0	15.0	15.2	8.7	11.6	11.0	5.6	4.5	19.8	2.6	100
Junior department	5.0	16.1	14.1	8.5	12.1	9.1	7.0	4.5	22.6	1.0	100
Total center customers	5.4	16.6	13.8	8.3	13.4	10.3	5.4	4.4	19.1	3.3	100
5 major store customers	6.3	17.6	13.8	8.2	13.7	10.0	5.5	4.6	17.9	2.4	100

petition, the junior department store, with 25,000 square feet of selling area, has a most restricted trading area.

This is an example of a shopping center that might have been more properly designed as a neighborhood type of center. Had sufficient acreage been available, its merits as a regional center might have been explored. But highway congestion at this site would have made a regional center undesirable, even if it had been possible to acquire additional land.

When a site is occupied by a combination of stores forming a major shopping strip or an integrated shopping center, then the combined drawing power of all stores will determine the trading area and the volume of customer traffic and business. While the limits of a shopping center are delineated by the drawing power of its most powerful store, every store in the shopping center will draw some business from all parts of the trading area, the intensity of draw for each store diminishing at a different rate with increasing distance. This will be reflected in variations in the share of market potential achieved.

In the case of Shopping Center C, the distinction between the drawing power of the various stores was analyzed (Table IV). In this case, the distinction between the draw of the junior department store and the supermarkets is minor. Knowing the characteristic pulling powers of various types of stores located within shopping centers is crucial to the tenant who must decide what rent he is willing to pay for the privilege of leasing store space in association with other stores. The pull of variety stores and of junior department stores that stress apparel and other soft goods is usually not significantly more extensive than the pull of supermarkets. As demonstrated by the case of Shopping Center C, any hopes that supermarket owners had of extending their trading areas because of their associations with the junior department store were quickly dispelled.

On the other hand, there can be substantial differences in the drawing power of stores, as in the case of the two major shopping strips noted on Figure 3. On Site G there are two stores—one, large Supermarket I with a selling area of 18,000 square feet; the other, Self-Service Department Store I with a selling area of 40,000 square feet. The varying drawing power of these stores is shown in Figure 16 and in detail, in Table VI.

In calculating the customer addresses spotted on the map, it was found that 77 per cent of the supermarket's automobile customers come from within three miles of the store, and 89 per cent

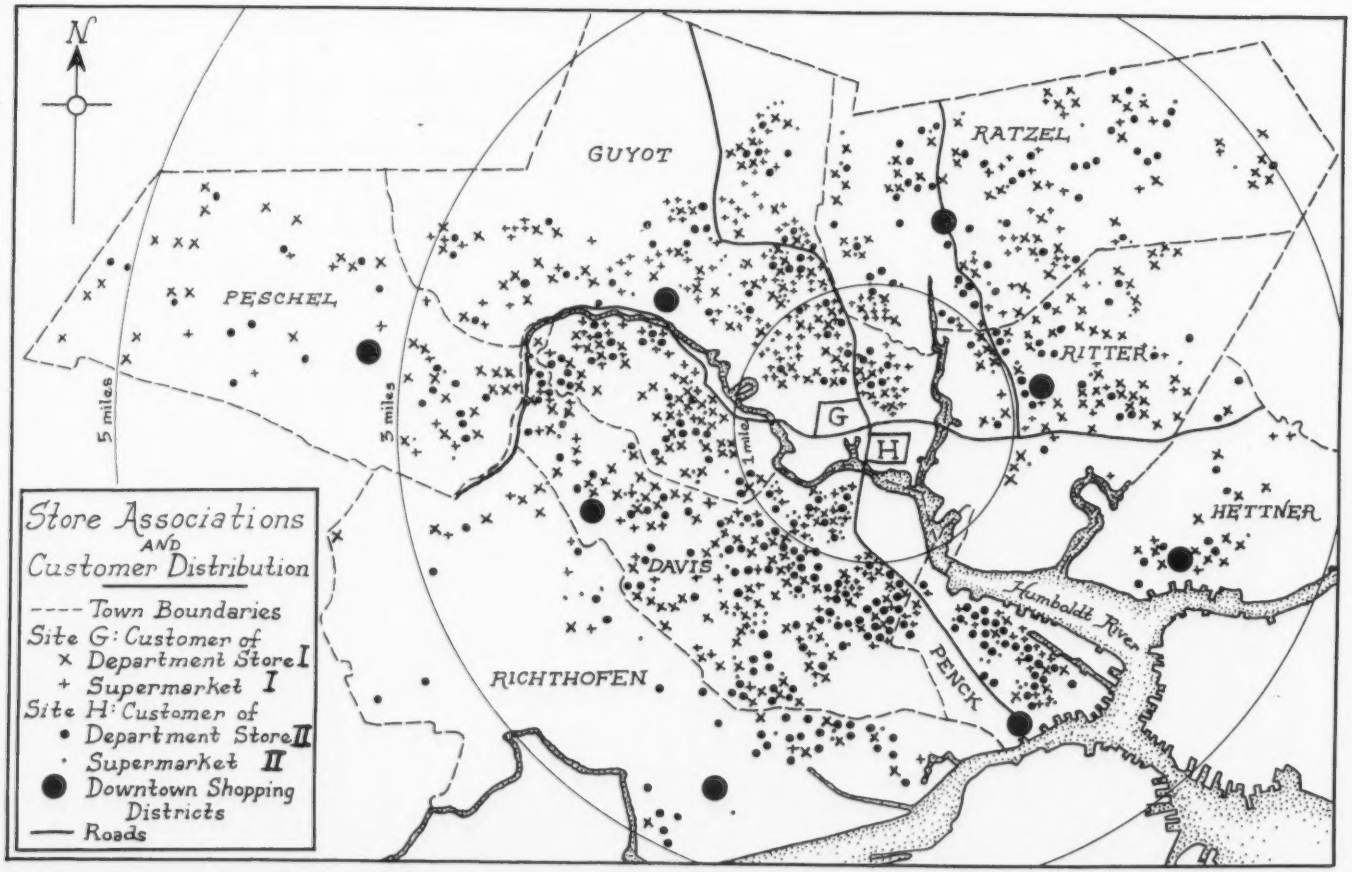
N
GUYOT
RATZEL
PESCHEL
RITTER
HETTNER
DAVIS
RICHTHOFEN
PENCK
Humboldt River
G
H
5 miles
3 miles
1 mile
Store Associations AND Customer Distribution
---- Town Boundaries
Site G: Customer of
× Department Store I
+ Supermarket I
Site H: Customer of
• Department Store II
· Supermarket II
Downtown Shopping Districts
— Roads

FIG. 16.

TABLE V

DRAWING POWER OF SUPERMARKET 1

Mileage zone	*1956 (Before opening of department store)*		*1958 (After opening of department store)*	
	Per cent of customers	*Cumulative per cent*	*Per cent of customers*	*Cumulative per cent*
0– ½	6.2	.....	5.3	.....
½–1	12.3	18.5	12.6	17.9
1 –1½	26.6	45.1	26.7	44.6
1½–2	15.1	60.2	16.4	61.0
2 –3	12.1	72.3	15.6	76.6
Over 3	27.7	100.0	23.4	100.0
	100.0	.....	100.0	.....

from within five miles. On the other hand, only 58 per cent of the department store customers reside within three miles, and 73 per cent within five miles. In totaling customers from the closest cities, it was found that the nine nearby cities provide the supermarket with 85 per cent of its customers; these same cities provide the department store with 56 per cent of its customers.

The supermarket was constructed in 1956. The department store was opened a year later. Since the opening of the department store, the sales of the supermarket have increased by 10 per cent. When two such stores, with varying drawing powers, are located side by side, careful analysis is required to establish whether this location association is important in terms of trading area extent (i.e., drawing power) or in market penetration.

In this case the impact of the self-service department store upon the supermarket has been examined by studying the distribution of supermarket customers both before and after the building of the department store. The results are shown in Table V.

It is noteworthy that the supermarket customer drawing power has remained unchanged. The increase in sales has resulted from a greater penetration of the existing trading area, and not from an expansion of the trading area. In this instance, therefore, the self-service department store has not helped the supermarket to reach out farther; it has, rather, enabled the supermarket to intensify its penetration.

On the other hand, on Site H, Supermarket II, with only 12,500 square feet of selling area, when associated with the larger Self-Service Department Store II, with 50,000 square feet of selling area, increased its volume by 15 per cent. This was found to be due both to an extension of its trading area boundaries and an increase in market penetration.

The more extensive nature of the trading area of Supermarket II can be seen from Table VI.

We have outlined the major marketing considerations in evaluating a store site. The majority of cases are drawn from supermarkets and shopping centers, but the methods of analysis and tools would appear to be applicable to most forms of retail outlets.

Several operating considerations also affect store site evaluation, because they affect profit potential. Labor expense is by far the largest single operating expense. Hence, there is always the consideration of available labor supply, pay rates, and union conditions. A company operating a chain of stores must also consider the distance of the site from the warehouse and headquarters for servicing and supervision. It

must take into account total or incremental advertising expense that will be required. In some instances special fees and taxation, particularly personal property tax, may be a significant operating expense. Regulations affecting store business hours can enhance or diminish the value of a site.

The profit potential of a store site must be related to return on capital investment. This investment comprises equity in land and building, if any, in store equipment and merchandise, plus any back-up merchandise and facilities that may be needed to service the store.

Return on investment involves short- and long-range considerations, and a choice of methods for calculating return usually figured on a pretax basis. To pioneer too soon or too large in a newly developing area may not be a wise investment. If a store at a given site is not likely to achieve its full sales and profit potentials until several years after opening, perhaps another location should be found where a satisfactory return on investment can be achieved sooner. In the latter case the earnings, as they become available, can be promptly reinvested.

From the presentation which has just been made, it follows that a store site evaluation is really not complete without a detailed analysis covering estimated sales, operating expenses, profits from sales, capital investment requirements, and return on investment.

FACTORS WHICH DETERMINE RENTAL

Next, let us look at the factors which determine a store's real estate costs regardless of whether it is owned or rented. These factors include land and building cost; debt service charges; operating costs such as real estate taxes, insurance, repair, and maintenance; and, last but not least, negotiation.

Land cost is derived from several considerations. First, there is the physical character of the land—flat versus rolling, good bottom versus ledge or swamp. Next is accessibility and utilities. Acreage without access roads and without public utilities is raw land. Expenditures to prepare land to put a building on it are an added cost to the project. Therefore, the less improvement required, the greater is the value of the undeveloped land.

The physical character of the land and zoning regulations may require special architectural treatment of the building. Insofar as this adds to building cost, the value of the land is adversely affected. An exorbitant real estate tax on the land, while constituting an operating expense, diminishes the relative value of the land.

Every piece of land is unique in its

TABLE VI

1958 DRAWING POWER FOR SITES G AND H

Mileage zone	*Supermarket I*	*Supermarket II*	*Self-service department store I*	*Self-service department store II*
	Per cent	*Per cent*	*Per cent*	*Per cent*
0 – ½	5.3	2.4	2.1	0.8
½–1	12.6	11.9	4.7	4.8
1 –2	43.1	49.3	29.9	30.2
2 –3	15.6	13.3	20.9	21.8
3 –5	12.6	5.8	14.9	18.4
Over 5	10.8	17.3	27.5	24.0
	100.0	100.0	100.0	100.0

geographic location and its physical characteristics. Therefore, there is always the problem of arriving at its value for a specific purpose. A real estate developer or a retailer may know from past experience or from rule of thumb how much he can afford to pay for a given piece of land in relation to a projected use. On the other hand, he may arrive at how much he can afford to pay for the land after calculating all other factors involved in the project.[7]

The building cost is a matter of providing the tenant's specified requirements and meeting the local building code. If the tenant wants air conditioning, magic carpet doors, and terrazzo floors, he has to pay for these. The landlord usually secures several competitive bids from contractors to obtain the most favorable building cost.

The debt service charge is a combination of the interest rate and the mortgage amortization period. The landlord's and tenant's credit positions affect the interest rate, the length of the loan period, and frequently also the size of the loan that can be obtained.

Current operating costs—including real estate taxes, insurance, repair and maintenance, heat and air conditioning, snow removal, etc.—are part of occupancy cost paid for by the tenant. In a gross rent lease, the landlord estimates these current operating costs and incorporates them into the rental. In a net rent lease, the tenant pays the actual current operating expenses as they occur. Some landlords insist on rental adjustments for changes in real estate taxes even in the case of a gross rent lease.

The arithmetic involved in calculating a store rental can best be illustrated by an example of the so-called "buy-build-sell-leaseback" arrangement. Here a merchant buys a piece of land, builds a store to meet his needs, sells the property at his cost to an insurance company, and takes a lease on the property from the new owner. Usually, such leases are net rent leases. If the lease is for 20 years plus one or two 10-year options, then the net rent for the first 20 years would most likely be 8½ per cent of the purchase price, and 2½ per cent and 2 per cent, respectively, for the first and second 10-year options. In this arrangement the 8½ per cent net rental would permit paying off the full investment cost in 20 years on a 5½ per cent interest and a 3 per cent amortization direct reduction basis. On such a basis, annual net rental is constant but the dollar annual amortization increases as the dollar interest payment decreases. A private investor would also take such a deal on the same terms. Most likely he would only put in a relatively small amount of his own equity capital and would obtain a mortgage on the balance.

IMPORTANCE OF NEGOTIATION

While land, building, financing, and operating costs are the ingredients composing rental, the specific rental and lease terms of a store location are shaped by negotiation. Negotiation involves physical facilities and services to be provided, gross versus net lease, flat versus percentage rental, length of lease, renewal options, cancellation and assignment privileges, restrictions, and exclusiveness.

In negotiation there is a very important element which we might call "power of negotiation." The tenant's power position derives from the stature of the company and of the negotiator himself.

[7] While this paper deals essentially with new store facilities, the general concepts presented here apply also to existing store facilities in long-established business centers. In the latter case, the value placed on an old building may be an appraised rather than a residual book value. The land value will be a derived value and may exceed that of the building. The more strategic the geographic location for the desired business use, and the greater the number of alternative uses for the location, the higher will be the land value.

The company's stature is a composite of such attributes as size, profit record, progressiveness, type of stores, merchandising skill, and good will in the community. Lack of sufficient stature may preclude even an invitation to negotiate for a store location in a shopping center development. The negotiator's stature is a composite of his position in the company and authority in negotiating; his prestige and contacts outside the company; his knowledge of the market, costs, regulations, and real estate activities; and his negotiating tact and resourcefulness.

The landlord's power position derives from the scope of his real estate and other business activities; from his financial position and good will in the community; from his knowledge of the tenant's needs; and from his skill in negotiating.

The power of negotiation is affected by the amount and type of competition for a store location. It is also affected by timing. Where a successful shopping center is under expansion, the landlord's bargaining position is strengthened. So long as such competition is "rational" and is tempered by the economics involved, the power of negotiation is "balanced." If the situation reaches a stage of auction bidding, the landlord is likely to add at least a touch of draft under the fire. In an auction bidding situation, "emotional" competition may precipitate a price war in reverse. Some companies, however, are determined to negotiate only on a rational economic basis.

Usually, there is some give and take in negotiation. Concessions are made by both sides. The nature of these concessions are of two kinds: (a) matters of adaptation or convenience, and (b) true economic concessions.

In the first instance, the concessions involve, "I'll do this, you do this," or "Get more, pay more; take less, pay less." Thus, the landlord and tenant may negotiate as to which of them will install such items as electric fixtures, air conditioning equipment, or floor covering. Or, they may negotiate regarding the store size, basement or parking area. Here the landlord, because of other objectives, may want the tenant to take either more or less than the latter's specifications call for. Likewise, the tenant may seek to persuade a reluctant landlord to give him a more strategic position within a shopping center. The list of such matters of adaptation or convenience which enter into negotiation is very long.

In the second instance, one party agrees to make an economic sacrifice in favor of the other party. This results either in a lower rental for the tenant or in a higher return for the landlord. For the most part true economic concessions made by either party are likely to be of minor magnitude.

There are some areas of negotiation which involve both types of concessions. Thus, the tenant may secure a shorter lease term at a somewhat higher rental in recognition of the accelerated amortization involved in discharging a loan over a shorter period. The landlord is bound to a renewal option but the tenant is not. Nonetheless, the tenant seeks favorable renewal terms on the landlord's amortized property. In granting assignment or cancellation privileges to a tenant, the landlord assumes a hazard if the location should deteriorate too fast.

The advantages gained from concessions are either short- or long-range. They are anticipated (or hoped-for) or precautionary. A landlord in a weak financial position may seek a short-range advantage from prepayment of the first year's rent. On the other hand, a tenant may anticipate to benefit long-range from very favorable renewal options.

Let us touch on the differences in negotiating for a free-standing and for a shopping center location. In the case of a free-standing location, the one tenant has to bear the burden of the entire investment of land, building, and financing charges plus real estate taxes, insurance, and maintenance. In the case of a shopping center, the developer considers the cost of putting "the real estate package" together. He negotiates with each tenant separately for different terms. He aims at a fair return on the investment and generally hopes to get his maximum profit from the income on the sales exceeding the minimum rentals. The various tenants wind up with different deals on length of lease and renewal options, on base rent paid per square foot of building space, and on percentage rent to sales.

The range of percentage rent to sales is from about 1 per cent for supermarkets to about 10 per cent for jewelry stores selling inexpensive jewelry. Service charges are prorated on the basis of sales, store area, or store frontage. Tenants which contribute the greatest drawing power to the shopping center receive the most favorable lease terms. Sometimes they secure a rental on a "loss leader basis"—less than the landlord's cost of the space involved. Generally, the landlord imposes some restriction as to the lines of merchandise which a tenant may sell. Tenants seeking exclusiveness, that is barring of competitors with the same types of merchandise, must pay for this consideration. In evaluating the aggregate of his negotiations, the landlord considers what he will get from the deal for his equity, effort, and the risk involved. He tries to determine how much he is going to get back each year after his tax deductions, and he generally employs a skilled tax accountant to guide him.

In these negotiations, it is neither all science nor economics. There is much horse trading. Where the developer is both landlord and major tenant (the department store or supermarket of the shopping center) and he is in a strong financial position and experienced, he negotiates from great strength and makes very few economic concessions. If the developer is only a landlord and is financially weak and inexperienced, then, unless he has a "monopoly" site, he is in a poor position in negotiating with major tenants. He may be forced, for lack of adequate financing, to abandon his project.

Whether a retailer negotiates for a free-standing location or for one in a shopping center, his rental commitment must be based on a realistic appraisal of the sales he can expect to achieve with sound merchandising and operations. If he has an impressive array of supporting research data to present during the negotiations, he can achieve a more favorable deal with the landlord.

Frequently a retailer chooses to be his own landlord. In making such a decision, he considers the advantages and disadvantages of owning the real estate versus investing the capital in expansion of sales outlets. If he cannot get a landlord to build a store for him, he may have to become his own landlord or pass up a desirable location. After the store is built, he may decide to sell the property on a leaseback basis. As his own landlord, he has greater flexibility than as tenant in making structural changes and in financing them, in acquiring additional parking facilities, and in terminating his occupancy. When the building is amortized, he owns a debt-free property which may still have a substantial market value.

In recent years some supermarket and department store operators have been very active in expanding their real estate as well as retailing enterprises. They have organized separate companies which are developing retail busi-

ness properties, including some of the largest regional shopping centers in the United States and Canada. In so doing, they are both landlord and tenant.

THE NEED FOR MORE STORE LOCATION SCIENCE

Both tenant and landlord spend much time in negotiating a store lease. This they do to work out satisfactory terms. Insofar as either the one or the other may gain some concessions from the expenditure of effort, these concessions are small in relation to the total lease commitment. For example, in the case of a modern supermarket, a 20-year lease may involve a commitment of $500,000. Certainly the tenant has much at stake. This, it would seem, justifies substantial location research in advance of lease commitment.

On the whole, retailers and shopping center developers have fared very well in the postwar years in their store site selection and evaluation, with or without genuine store location research. But there has also been a measure of economic waste. The Super Market Institute's survey about new supermarkets opened in 1958 showed that 63 per cent of these stores were doing less business than was expected, 30 per cent did more, and 7 per cent just about as anticipated. The difference between actual and estimated sales ranged from 44 per cent below forecast to 71 per cent above. If a 10 per cent margin of tolerance is allowed, 44 per cent of the new supermarkets did less sales than anticipated, 21 per cent more, and 35 per cent about as expected. This same survey observes, "A larger proportion of the new super markets than in previous years are not living up to (sales) expectations." Thousands of individual stores of various types and many shopping centers have failed to achieve fully the anticipated sales and profit. Better store site evaluation and store grouping in shopping centers could have minimized this economic waste and the emotional toll of business disappointment.

It should be emphasized that store site evaluation or store location research is still more art than science. Researchers in this field definitely employ scientific methods insofar as possible, but the raw statistical and other data with which they have to work are not always adequate, largely due to incompleteness. Furthermore, they lack sufficient practical standards for comparative evaluation.

Unfortunately, there is no short cut to science. What is needed first is more store location facts about existing retail establishments. Some information is now available; but not enough, partly because of disinclination to release such information, partly because of inertia in preparing the data for publication, and mostly because store location research is a newcomer. What is especially needed is information on shopping center and individual store trading areas, on drawing power, on customer shopping habits, and on share of the market realized in relation to potential. An effort should be made to secure such existing information from shopping center developers and retailers. When secured, the information will require evaluation and integration for intelligent use. This, in turn, will supply material for broader concepts and theoretical formulations without which there is little science.

Our schools, particularly at the graduate level, can make an important contribution in this area of knowledge. Here are opportunities for research projects, for new teaching material, and for professional service to business. Perhaps, in time, two or three universities may become centers for store location research and clearinghouses for store location information.

A MAP OF THE USSR'S MANUFACTURING

Richard E. Lonsdale and John H. Thompson

Mr. Lonsdale is a research assistant in the Department of Geography, Syracuse University. He has a Ford Foundation fellowship for the year June, 1959, to May, 1960, to support his dissertation work on industrial expansion in western Siberia. Dr. Thompson, Professor of Geography at Syracuse, has specialized in the geography of manufacturing.

MANUFACTURING production in the Soviet Union is at least half that of the United States and the country is clearly the world's second industrial nation.[1] Such current importance together with a rapid growth rate makes the distribution of manufacturing and its causes of increasing concern to students of the Soviet economy. The only detailed manufacturing maps available show the distributions as of 1935.[2] Newer maps have been small-scaled, show only the general location of selected types of industrial activity, and provide but a vague indication of the relative magnitudes of manufacturing in the various industrial regions and urban centers.

This paper presents a map (Fig. 1) showing the relative importance of manufacturing in the 571 leading industrial centers of the Soviet Union. It also discusses the problems and methods involved in construction of the map, and interprets briefly the patterns exhibited by it. Table II supplements the map and cites the major types of production in the industrial centers.

[1] The following gives some indication of comparative production levels:

USSR as a Percentage of the United States

	1957	1958 estimate
1. Gross national product	42	n.a.
2. Production of steel	50	71
3. Generation of electricity	30	33
4. Mining of coal (USSR 30 per cent lignite)	99	112
5. Manufacturing employment	113	133

[2] A series of these maps appeared in the *Bol'shoy Sovetskiy Atlas Mira* (Great Soviet World Atlas), 2 vols. TsIK SSR, Moscow, 1937–39. Another detailed manufacturing map appeared in a 1940 textbook, which has been translated into English: S.S. Balzak, et al (eds.), *Economic Geography of the USSR*, Macmillan, New York, 1952, Fig. 27.

The Map and Its Construction

Limitations of Soviet source material provided obstacles to construction of the map. Because quantitative data on manufacturing for Soviet industrial centers is unavailable, the problem could not be approached directly on a city-by-city basis. Two steps had to be taken. First, the magnitudes of manufacturing in 23 regional divisions of the country were calculated, using 1955 Soviet statistics for the *number of workers* and *amount of fixed capital* in manufacturing for each of these 23 divisions.[3] This provided a means of regional control for the second step, which involved estimating the amount of manufacturing at each industrial center within the 23 regional divisions. A wide variety of descriptive and statistical data served as a basis for this purpose. All estimates of magnitude are in

[3] The 23 regional divisions referred to here and covered by Soviet statistics include nine subdivisions of the RSFSR and the remaining 14 republics. They are listed in Table I.

TABLE I

MAGNITUDE OF MANUFACTURING IN 23 REGIONAL DIVISIONS OF THE USSR, 1955

	En *Number of workers in manufacturing in per cent of USSR total*	*Cn* *Amount of fixed capital in manufacturing in per cent of USSR total*	$M = (\frac{En + Cn}{2})$ *Magnitude of manufacturing*
USSR	100	100	100
RSFSR	68.9	63.8	66.35
North	2.2	1.9	2.05
Northwest	6.5	6.2	6.35
Central	27.8	18.8	23.30
Volga	5.3	5.4	5.35
N. Caucasus	3.9	5.0	4.45
Urals	11.6	13.8	12.70
W. Siberia	5.7	5.2	5.45
E. Siberia	3.2	3.9	3.55
Far East	2.7	3.6	3.15
UKRAINE	17.3	20.2	18.75
MOLDAVIA	0.5	0.4	.45
BELORUSSIA	2.6	1.6	2.10
ESTONIA	0.7	0.7	.70
LATVIA	1.1	0.8	.95
LITHUANIA	0.9	0.5	.70
GEORGIA	1.1	1.8	1.45
AZERBAYDZHAN	1.0	3.1	2.05
ARMENIA	0.6	0.7	.65
KAZAKHSTAN	2.6	3.4	3.00
UZBEKISTAN	1.6	1.7	1.65
TURKMENISTAN	0.3	0.6	.45
KIRGIZIYA	0.5	0.4	.45
TADZHIKISTAN	0.3	0.3	.30

terms of percentages of the USSR total.[4]

Calculating the Magnitudes of Manufacturing in the 23 Regional Divisions

The magnitudes of manufacturing in the 23 regional divisions are based on 1955 Soviet statistics for the number of workers and amount of fixed capital in manufacturing. The number of workers in manufacturing can be computed in percentages of the USSR total from data contained in Soviet statistical handbooks.[5] The percentage of the USSR's fixed capital in manufacturing is given directly.[6] The two criteria are arbitrarily weighted equally, and the two-criteria magnitude rating may be expressed as

$$M = \frac{En + Cn}{2}$$

where M is the magnitude of manufacturing, En is the number of workers in manufacturing expressed in percentage of the USSR total, and Cn is the amount of fixed capital in manufacturing expressed in percentage of the USSR total. The use of these two criteria minimizes regional abnormalities that one criterion may exhibit.[7] They tend to complement each other, for the num-

[4] The Soviets include mining, the generation of electric power, lumbering, and fishing with true manufacturing. Their inclusion does not appreciably change the overall distributional pattern, but certainly magnifies the importance of some mining centers such as Baku, Krivoy Rog, and Karaganda.

[5] *Narodnoye Khozyaystvo RSFSR—Statisticheskiy Sbornik* (National Economy of the RSFSR—Statistical Handbook), Gosstatizdat, Moscow, 1957, pp. 11–41; and *Promyshlennost' SSSR—Statisticheskiy Sbornik* (Industry of the USSR—Statistical Handbook), Gosstatizdat, Moscow, 1957, pp. 23–24.

[6] *Promyshlennost' SSSR*, p. 18. Soviet economists computed the amount of fixed capital, or stock of capital, in industry by totalling the original values of all items in the year in which they were acquired. Prices are adjusted to a common base, but no allowance is made for depreciation.

[7] The value of using more than one criterion in magnitude measurement has been dealt with at length in John H. Thompson: "A New Method for Measuring Manufacturing," *Annals of the Assn. Amer. Geogrs.*, Vol. 45, 1955, pp. 416–436.

ber of workers is sometimes relatively high in comparison to fixed capital in such industries as textiles, coal mining, etc., and in other cases, such as the chemical industry, the opposite is true. Both the individual and two-criteria ratings are shown for the 23 regional divisions of the USSR in Table I. It can be seen from this table that differences between the individual and two-criteria ratings for most of the 23 regions might hardly justify the extra work of calculating the latter. On the other hand the difference exhibited in the Central Region alone seems to warrant the procedure.

Estimating the Magnitudes of Manufacturing at Individual Centers

After establishing quantitative control for manufacturing in the 23 regional divisions of the USSR the next problem was properly to distribute manufacturing magnitude among the industrial centers within each of the 23 regions. At this point direct quantification necessarily ceased and estimation began. However, enough information is available to give considerable credence to the estimating process.

Economic maps, population data, and voluminous descriptive accounts were used in making the estimates. Economic maps in a Soviet atlas and in Soviet regional economic geographies[8] show the location of manufacturing according to type of activity (ferrous metallurgy, agricultural machinery, flour milling, etc.). The symbols employed are ordinarily of four sizes, but there is no indication of just how much manufacturing is represented by each size of symbol. The detailed manufacturing maps in the pre-World War II *Bol'shoy Sovetskiy Atlas Mira* are also of some use as distributional guides even though they are now almost 25 years out of date. Ordinarily the population of a center gives some indication as to the magnitude of manufacturing in that center.[9] Many books present reasonably accurate descriptions of the nature of manufacturing activities in individual centers and the relative importance of manufacturing to the center's economy.[10]

This wide variety of economic maps, fairly complete population data, and voluminous descriptive but generally non-quantitative accounts, was synthesized and used as a basis for distributing manufacturing magnitude among industrial centers. The specific nature of the estimating process can be best illustrated by an example. The formula, $M = \frac{En + Cn}{2}$, establishes that the Ukraine has 18.75 per cent of the

[8] *Geograficheskiy Atlas* (Geographical Atlas), GUGK, MVD SSSR, 1956, pp. 143–155. Of the many regional economic geographies, the best to date is *Kazakhskaya SSR* (Kazakh SSR) Geografgiz, Moscow, 1957.

[9] Soviet population estimates for January 1, 1956, are available for all cities of 50,000 or more in the RSFSR in *Narodnoye Khozyaystvo RSFSR*, pp. 48–49, and for cities of 100,000 or more in the USSR in *Narodnoye Khozyaystvo SSSR—Statisticheskiy Sbornik* (National Economy of the USSR—Statistical Handbook), Gosstatizdat, Moscow, 1956, pp. 8–9. Estimates of 1950 population of all cities with over 50,000 persons and economically important centers with less than 50,000 population are given in Theodore Shabad, *Population of Major Cities of the USSR*, Research Memorandum 815-1, The Rand Corporation, Santa Monica, 1952. Town symbols on Soviet maps indicate populations of less than 10,000 and those with from 10,000 to 50,000.

[10] These include N. N. Baransky: *Economic Geography of the USSR*, Foreign Languages Publishing House, Moscow, 1956; George B. Cressey: *How Strong is Russia?*, Syracuse, N. Y., 1954; Werner Leimbach: *Die Sowjetunion—Natur, Volk, and Wirtschaft* (The Soviet Union—Nature, People, and Economy), Franckh'sche Verlagshandlung, Stuttgart, 1950; Theodore Shabad: *Geography of the USSR*, New York, 1954; P. N. Stepanov: *Geografiya Promyshlennosti SSSR* (Geography of Industry in the USSR), Uchpedgiz, Moscow, 1955; and the previously cited S. S. Balzak: *Economic Geography of the USSR*. Descriptions of individual cities appear in the Great Soviet Encyclopedia. In addition, the regional economic geographies referred to in footnote 8 above contain valuable descriptions of economic activities in individual centers.

USSR's manufacturing. The problem is to distribute this 18.75 per cent share among the many Ukrainian manufacturing centers. First, a list was prepared of 125 centers with a population of at least 10,000 and which contain reasonable amounts of manufacturing as indicated by maps and descriptive accounts.[11] The 18.75 per cent share for the Ukraine was first divided up among the 125 centers in direct proportion to the population of these centers. On this basis it turns out that in the Ukraine .05 per cent (the smallest unit of measurement thought practicable for use in this study) of the USSR'S manufacturing is represented by a population of 30,000.[12]

Thus, based on population alone, Stalino would receive 1.05 per cent, Kiyev 1.65 per cent, and Sevastopol' .20 per cent. Adjustments were then made up or down depending on the nature of manufacturing activity and the relative importance of manufacturing in each center, as identifiable from the various sources of information. Stalino, because of its extensive ferrous metallurgical, machine, chemical, and coal mining industries, involving a large fixed capital and a very high percentage of the town's workers, was upgraded to 1.30 per cent. Kiyev has very important machine, food, chemical, and textile-clothing industries, but because of the extensive commercial and administrative activities in the city also employing many workers, it was decided that its figure should be adjusted slightly downward to 1.60 per cent. In Sevastopol', a major naval base and port city, manufacturing is only of secondary importance, and it was thus downgraded from .20 to .10 per cent.

After applying the above estimating process to the 125 Ukrainian centers it was deduced that only 43 centers possess as much as .10 per cent of the USSR's manufacturing. These 43 centers, however, account for 16.40 per cent out of the original 18.75 per cent allotted to the Ukraine. The remaining 2.35 per cent occurs in the other 82 centers whose individual contribution is less than .10. This 2.35 per cent is divided equally among 47 centers which are thought to be the most important of the remaining 82. Each is given a magnitude of .05 per cent, which determines the number 47 $(\frac{2.35}{.05})$. Thus although 35 minor centers of the original 125 considered are omitted from the map, the manufacturing in these 35 centers is accounted for on the map in the centers with a .05 designation. Even if adequate statistical data were available for estimating manufacturing in these 35 centers, and even in more minor ones, the pattern exhibited by the map most certainly would not be significantly different.

In total, 902 centers in the USSR were examined. Of these, 245 were deduced to have at least .10 per cent of the country's manufacturing, and together account for 83.70 per cent of the total. These, the major centers, are shown by circles on Figure 1. Most of the remaining 16.30 per cent of the manufacturing is found in the other 657 smaller centers whose individual contribution is less than .10 per cent. Since .05 per cent is the smallest unit of measurement attempted, the 326 $(\frac{16.30}{.05})$

[11] This procedure excludes many small centers with less than 10,000 population, but the majority of them are agricultural or transportation centers. The combined manufacturing in such small centers is thought to amount to not over 4 or 5 per cent of the USSR total; this is partially explained by the Soviet preference for large-scale industrial enterprises.

[12] This varies among the various regional divisions, depending on the kind of economy that predominates. In 1955, there was a national average of 8683 industrial workers per .05 per cent of Soviet manufacturing.

most important smaller centers were selected, and are shown on the map as minor centers through use of dots. Thus, 571 centers (245 major and 326 minor) appear on Figure 1.

DISTRIBUTION OF MANUFACTURING AS ILLUSTRATED BY THE MAP

Figure 1 substantiates the generally recognized importance of manufacturing in Soviet Europe. If anything, it portrays a somewhat more widespread pattern than is ordinarily described for this area. Soviet Europe, including the Urals and Caucasus, accounts for 82.0 per cent of the nation's manufacturing, leaving only 18.0 per cent for Soviet Asia. This relatively limited Asiatic development would hardly seem to warrant the widespread publicity given to it in geographic literature and in news accounts. The apparently exaggerated position of Asiatic manufacturing can be blamed on the Soviet practice of referring to industrial development in the "east" which to them means anywhere east of the Volga and thus includes the Urals and areas between the Urals and the Volga.

The Soviet Manufacturing Belt

The concept of a manufacturing belt was dealt with by Sten DeGeer[13] in 1927 and subsequently supported by Hartshorne[14] and others. It has proven to be useful in describing distribution and growth trends in American manufacturing. The question now might be raised as to whether manufacturing in Soviet Europe has attained "Belt" stature. The heavy line on Figure 2 represents a delineation of a large area of relatively high manufacturing concentration.[15] It is suggested here that this area or its approximation be referred to as the Soviet Manufacturing Belt. A part of the western boundary is the western boundary of the USSR. Leningrad forms the northwest corner of the belt, and Odessa the southwest corner. The northern boundary extends eastward from Leningrad to include the industrialized Urals region, and thence southwestward from the southern Urals to Stalingrad and Odessa. The belt is about 1500 miles in an east-west direction and about 1000 miles from north to south.

Although this area is larger in size and lower in manufacturing density than its American counterpart, the two belts exhibit a number of similarities. The Russian belt includes 72.3 per cent of the USSR's manufacturing which is very close to the per cent of the United State's manufacturing now in the American Manufacturing Belt. Within the Russian belt's boundaries are areas of higher manufacturing concentration similar to the subregions (Hartshorne's districts of concentration) of the American Manufacturing Belt. These subregions, like those in America, are composed of a hierarchy of areas with ever increasing degrees of concentration ranging from the metropolitan area through the city, the industrial district within the city, and finally to the individual plant where manufacturing land use reaches 100 per cent. A comparison of Figures 1 and 2 also illustrates the existence of large and small dispersed industrial centers between the subregions, another condition common to the American Manufacturing Belt.

[13] Sten DeGeer: "The American Manufacturing Belt," *Geografiska Annaler*, Vol. 4, 1927, pp. 233–359.

[14] Richard Hartshorne: "A New Map of the Manufacturing Belt of North America," *Econ. Geogr.*, Vol. 12, 1936, pp. 45–53.

[15] This line, based on Figure 1, was drawn without recourse to any distance-magnitude formula. Such formulas were experimented with, both for purposes of delimitation of the Belt and for purposes of outlining subregions within it, but none was identified that was workable with the raw data and on the scale employed here.

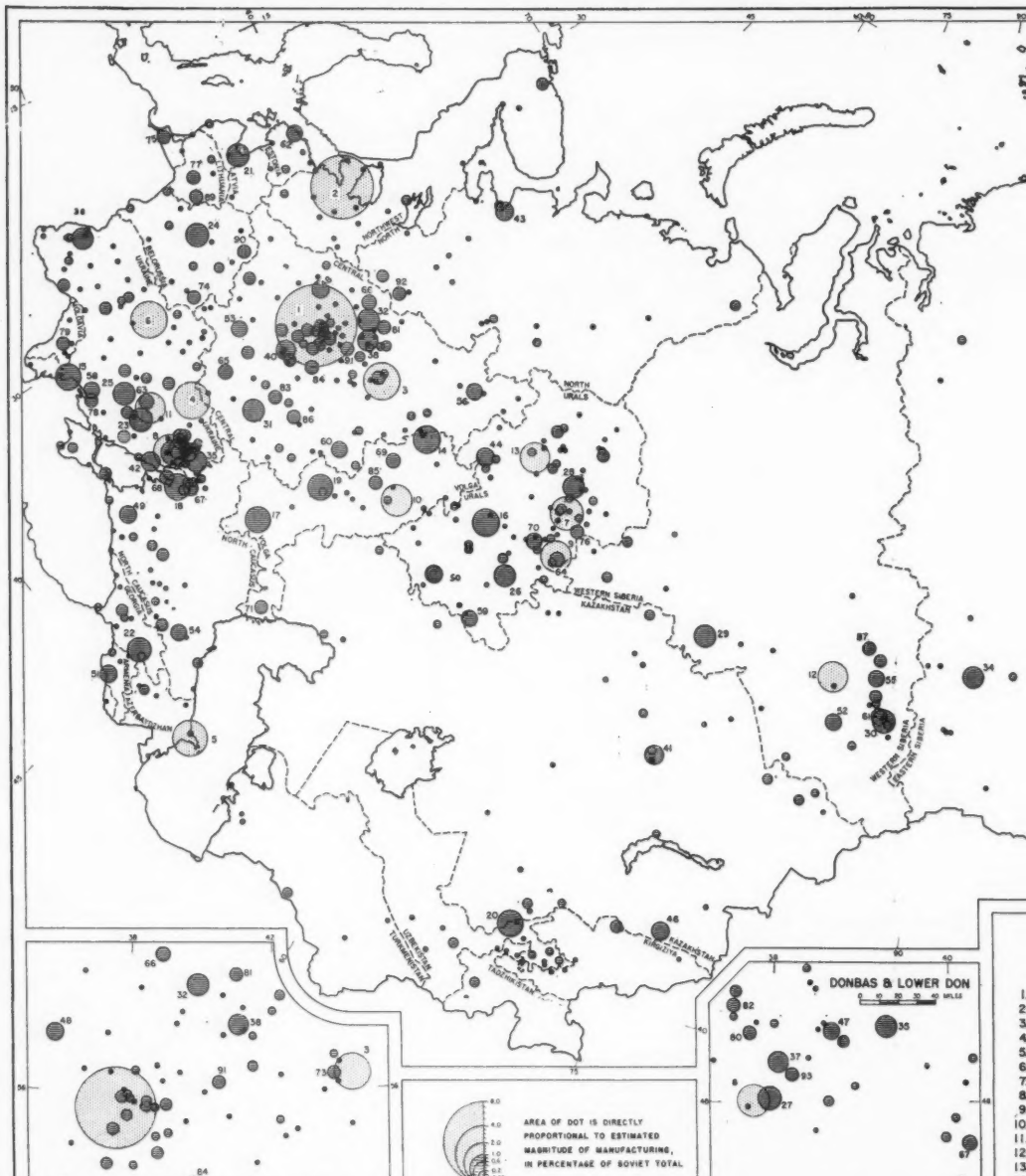
MOSCOW-GOR'KIY AREA
DONBAS & LOWER DON
AREA OF DOT IS DIRECTLY PROPORTIONAL TO ESTIMATED MAGNITUDE OF MANUFACTURING, IN PERCENTAGE OF SOVIET TOTAL
CIRCLE SCALE FOR BOTH MAIN MAP AND INSETS
NORTH URALS
VOLGA URALS
WESTERN SIBERIA KAZAKHSTAN
WESTERN SIBERIA EASTERN SIBERIA
UZBEKISTAN TURKMENISTAN
KAZAKHSTAN KIRGIZIYA
TADZHIKISTAN

FIG. 1. Manufacturing in the Soviet Union. (Based on the estimated magnitude of manufacturing in the more imp
circles of the same scale as on the main map, are designed to relieve the congestion which occurs in these areas on the ma
marginal grid indicators, but by a comparison of the positions of individual centers as designated by numbers. The map
included with manufacturing in Soviet statistics.

CENTERS WITH AN ESTIMATED 0.25 PERCENT OR MORE OF TOTAL SOVIET MANUFACTURING

INDICATED ON MAP BY NUMBER

1. MOSCOW, 8.20
2. LENINGRAD, 4.90
3. GOR'KIY, 1.65
4. KHAR'KOV, 1.65
5. BAKU, 1.60
6. KIYEV, 1.60
7. SVERDLOVSK, 1.45
8. STALINO, 1.30
9. CHELYABINSK, 1.25
10. KUYBYSHEV, 1.25
11. DNEPROPETROVSK, 1.10
12. NOVOSIBIRSK, 1.10
13. PERM, 1.10
14. KAZAN', .95
15. ODESSA, .95
16. UFA, .95
17. STALINGRAD, .90
18. ROSTOV, .85
19. SARATOV, .80
20. TASHKENT, .80
21. RIGA, .75
22. TBILISI, .75
23. ZAPOROZH'YE, .75
24. MINSK, .70
25. KRIVOY ROG, .65
26. MAGNITOGORSK, .65
27. MAKEYEVKA, .65
28. NIZHNIY TAGIL, .65
29. OMSK, .65
30. STALINSK, .65
31. VORONEZH, .65
32. YAROSLAVL', .65
33. IRKUTSK, .60
34. KRASNOYARSK, .60
35. LUGANSK, .60
36. L'VOV, .60
37. GORLOVKA, .55
38. IVANOVO, .55
39. KHABAROVSK, .55
40. TULA, .55
41. KARAGANDA, .50
42. ZHDANOV, .50
43. ARKHANGEL'SK, .45
44. IZHEVSK, .45
45. VLADIVOSTOK, .45
46. ALMA-ATA, .40
47. KADIYEVKA, .40
48. KALININ, .40
49. KRASNODAR, .40
50. ORENBURG, .40
51. YEREVAN, .40
52. BARNAUL, .35
53. BRYANSK, .35
54. GROZNYY, .35
55. KEMEROVO, .35
56. KIROV, .35
57. KOMSOMOL'SK, .35
58. NIKOLAYEV, .35
59. ORSK, .35
60. PENZA, .35
61. PROKOP'YEVSK, .35
62. TALLIN, .35
63. DNEPRODZERZHINSK, .30
64. KOPEYSK, .30
65. KURSK, .30
66. RYBINSK, .30
67. SHAKHTY, .30
68. TAGANROG, .30
69. UL'YANOVSK, .30
70. ZLATOUST, .30
71. ASTRAKHAN', .25
72. CHITA, .25
73. DZERZHINSK, .25
74. GOMEL', .25
75. KALININGRAD, .25
76. KAMENSK-URAL'SKIY, .25
77. KAUNAS, .25
78. KHERSON, .25
79. KISHINEV, .25
80. KONSTANTINOVKA, .25
81. KOSTROMA, .25
82. KRAMATORSK, .25
83. LIPETSK, .25
84. RYAZAN', .25
85. SYZRAN', .25
86. TAMBOV, .25
87. TOMSK, .25
88. ULAN-UDE, .25
89. VIL'NYUS, .25
90. VITEBSK, .25
91. VLADIMIR, .25
92. VOLOGDA, .25
93. YENAKIYEVO, .25

ore important centers.) Larger scale insets for the Moscow-Gor'kiy and Donbas and Lower Don areas, using the main map. Care should be taken to note the orientation of the insets; this is facilitated not only by the The map was compiled largely from 1955 Soviet data. Mining, generating electricity, lumbering, and fishing are

THE SUBREGIONS

Five subregions, containing 53.75 per cent of the USSR's manufacturing and about three-fourths that of the Soviet Manufacturing Belt, are shown on Figure 2. In rank order of magnitude they are: 1, Moscow-Gor'kiy; 2, Eastern Ukraine; 3, Urals; 4, Volga; and 5, Leningrad.

The Moscow-Gor'kiy Subregion contains 18.10 per cent of the nation's manufacturing. Moscow, the Soviet Union's greatest industrial center, can boast of 8.20 per cent of the nation's manufacturing. Other important centers in this subregion are Gor'kiy, the nation's third largest center, with 1.65 per cent, Yaroslavl' (.65), Ivanovo (.55), and Tula (.55). Despite limited mineral resources, this area has traditionally been the leader in manufacturing since the Tsarist period. Machine production with emphasis on precision equipment, textiles, clothing, chemicals, and publishing are all important.[16] The subregion is favored by its location at the heart of the Soviet transport system, and by proximity to markets, the seat of government, and a large skilled labor force. Although industrial production has increased at a rapid rate under Soviet procedures, the relative importance of this subregion within the USSR has declined slightly in recent years.

The Eastern Ukraine Subregion accounts for 14.00 per cent of Soviet manufacturing. It includes the Donbas (Donets Basin) with its large centers of Stalino (1.30 per cent of the USSR's total manufacturing), Makeyevka (.65), Lugansk (.60); the Dnepr Bend area where Dnepropetrovsk (1.10), Zaporozh'ye (.75) and Krivoy Rog (.65) are located; Khar'kov which ranks with Gor'kiy with 1.65 per cent; and the Lower Don area with the major center of Rostov (.85). This has long been the leading metallurgical and heavy-industry region of the country, although it is now being challenged by the more rapidly growing Urals region. Major industries include coal, iron and manganese mining, iron and steel manufacture, machine building, and chemical production. The region owes its continued importance to the extensive coal and iron ore deposits, a plentiful supply of electric power, a good transport system, and an experienced labor force.

The Urals Subregion has 11.75 per cent of the country's manufacturing. Major centers are Sverdlovsk (1.45), Chelyabinsk (1.25), Perm (1.10), Ufa (.95), Magnitogorsk (.65), and Nizhniy Tagil (.65). Relatively undeveloped prior to the revolution, this subregion has since become one of the most significant manufacturing concentrations and possibly will surpass the Eastern Ukraine in a few years. Processing of iron, copper, bauxite, chromium and potassium ores, ferrous and non-ferrous metallurgy, machine building, and chemical production are most important. Extensive and varied mineral deposits, particularly iron ore, have been the basis of industrial development. On the other hand, the area is poor in coking-quality coal. German occupation of the Eastern Ukraine during World War II stimulated growth and subsequent expansion has been rapid. It is recognized by Soviet planners that as the center of population moves eastward the location of the Urals Subregion will improve in respect of domestic markets.

The Volga Subregion, with 5.00 per cent of the nation's manufacturing, is considerably smaller than the three subregions described above. Also, there are fewer centers and the distance between them is greater. In fact there would be some doubt as to the validity

[16] See Table II for types of production in all Soviet centers.

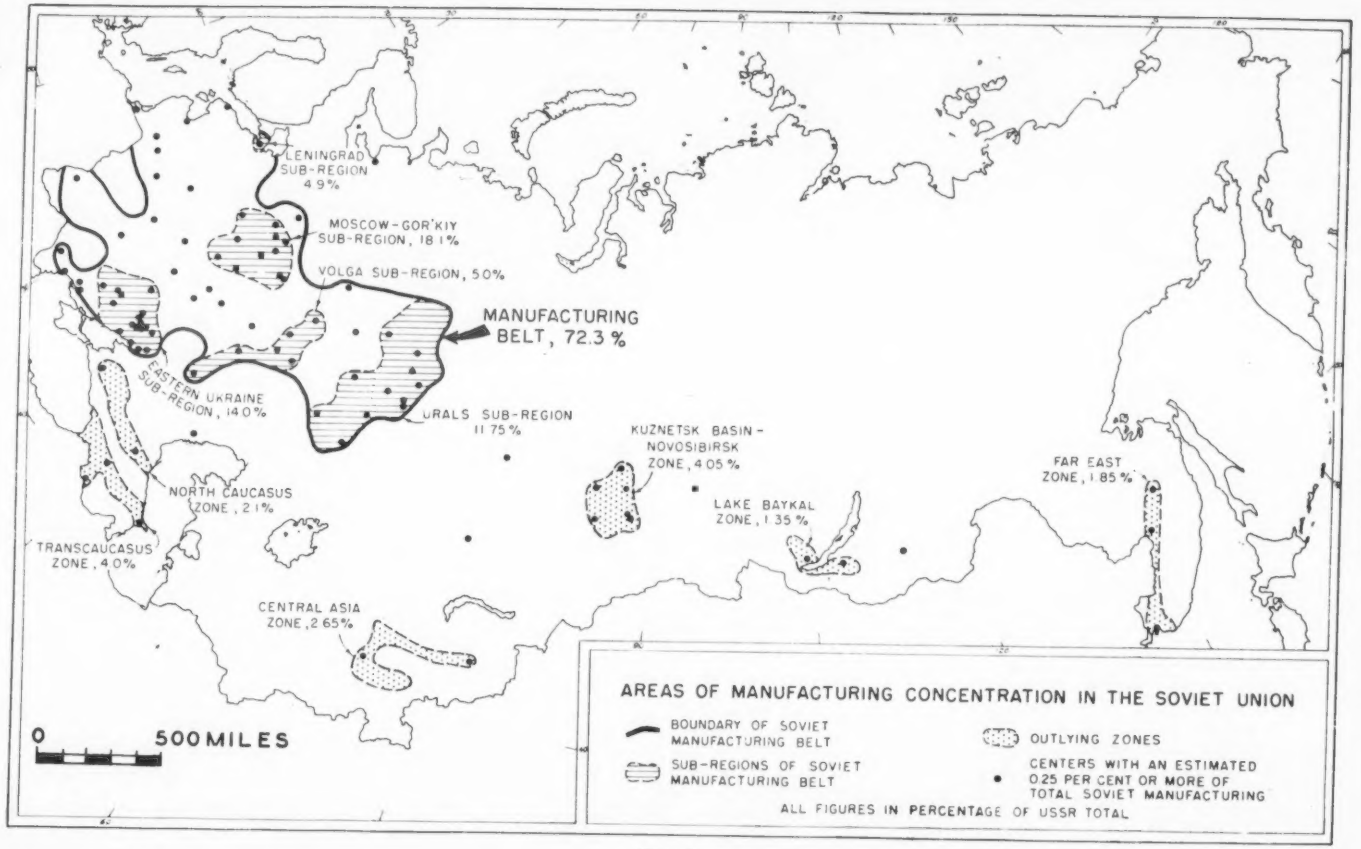
LENINGRAD SUB-REGION 4.9%
MOSCOW-GOR'KIY SUB-REGION, 18.1%
VOLGA SUB-REGION, 5.0%
MANUFACTURING BELT, 72.3 %
EASTERN UKRAINE SUB-REGION, 14.0%
URALS SUB-REGION 11.75%
KUZNETSK BASIN-NOVOSIBIRSK ZONE, 4.05%
FAR EAST ZONE, 1.85%
NORTH CAUCASUS ZONE, 2.1%
LAKE BAYKAL ZONE, 1.35%
TRANSCAUCASUS ZONE, 4.0%
CENTRAL ASIA ZONE, 2.65%
0 500 MILES
AREAS OF MANUFACTURING CONCENTRATION IN THE SOVIET UNION
BOUNDARY OF SOVIET MANUFACTURING BELT
SUB-REGIONS OF SOVIET MANUFACTURING BELT
OUTLYING ZONES
CENTERS WITH AN ESTIMATED 0.25 PER CENT OR MORE OF TOTAL SOVIET MANUFACTURING
ALL FIGURES IN PERCENTAGE OF USSR TOTAL

FIG. 2.

of referring to this area as a subregion were it not for its close internal orientation to the Volga River. The major centers are Kuybyshev (1.25), Kazan' (.95), Stalingrad (.90), and Saratov (.80). Nearly four-fifths of the manufacturing is in these centers. All four are united by the Volga River along which great quantities of oil, coal, timber, grain, and other bulk goods are transported. Machine building, oil refining, food processing, and production of building materials are most significant. Recent development of oil fields to the east of the Volga, which now provide almost two-thirds of the USSR's petroleum, has spurred industrial expansion. The several major hydroelectric installations which have been completed or are under construction along the Volga should attract new industries, particularly electrochemical and electrometallurgical types. It seems likely that both the growth of old centers and the emergence of new ones will proceed at a more rapid pace than in most other parts of the USSR.

The Leningrad Subregion, one of the oldest and best known, contains 4.9 per cent of the nation's manufacturing. It is limited to Leningrad and its immediate surroundings. Figure 1 shows that there are no very large centers within 200 miles of the city of Leningrad. It could, therefore, be argued that it be called simply a large dispersed center rather than a subregion. However, its relative importance and traditional recognition as a major manufacturing concentration lends support to it being designated a subregion. Leningrad is not favorably located with respect to mineral resources, but has long been known for its highly skilled labor force. Therefore, it emphasizes the manufacture of quality goods such as precision machines, electrical apparatus, and instruments of many types. Also important are the chemical, textile, and publishing industries. Despite considerable growth since the revolution, its relative importance has declined somewhat. This relative decline may continue if the general economic orientation eastward continues.

DISPERSED CENTERS

About one-fourth of the manufacturing in the Soviet Manufacturing Belt is located in dispersed centers geographically detached from the five subregions. Figure 1 shows 22 of these dispersed centers with .25 per cent or more of the USSR's manufacturing and 121 with between .25 per cent and .05 per cent. These centers are relatively more important than their counterparts in the American Manufacturing Belt. But this is probably as should be expected when the larger size but less maturity of the Soviet Belt is taken into consideration. Most of the dispersed centers began as supply points for surrounding agricultural areas and many are noted food processing centers. The larger ones, usually situated favorably at transport junctions, contained suitable sites for factories and profited immensely from the Soviet industrial revolution. The value of dispersion from a strategic or regional development point of view also was instrumental in spurring growth in numerous centers.

The most notable dispersed center is Kiyev (1.60), the Ukraine's second ranking manufacturing city. Here, machine building, chemical production, and food processing are outstanding. Odessa (.95) is a major port city of the grain-producing Ukraine and has extensive food processing, clothing, machine and chemical industries. At Minsk (.70), the major city of Belorussia, the most important types of manufacturing are machine building, and food processing.

TABLE II

TYPES OF PRODUCTION IN SOVIET MANUFACTURING CENTERS

Center	Population in 000's	Magnitude of Manufacturing as Figured in Direct Proportion to Population*	Type of Manufacturing Activity**	Relative Importance of Manufacturing in Economy***	Estimated Magnitude of Manufacturing
NORTH REGION--2.05 percent of total Soviet manufacturing; population in the 25 centers considered averages 24,000 per .05 percent of Soviet manufacturing*					
Arkhangel'sk Oblast					
Arkhangel'sk	238	.50	A5;E1;M4;03	2	.45
Konosha	10-50	.05	E1	2	.05
Kotlas	40	.10	A5;E1;M1	2	.10
Nyandoma	10-50	.05	03	2	.05
Onega	10-50	.05	E1;03	2	.05
Plesetsk	10-50	.05	E1;03	2	.05
Severodvinsk	68	.15	E1;M4	2	.15
Vel'sk	10-50	.05	03	3	.05
Komi ASSR					
Mikun'/Zheshart	15	.05	E1	2	.05
Pechora	10-50	.05	E1	2	.05
Syktyvkar	51	.10	E1;L1	2	.10
Ukhta/Irkha	20-50	.05	M4	2	.05
Vorkuta (inc. suburbs)	90†	.20	F1	3	.15
Vologda Oblast					
Cherepovets	75	.15	J1;L1	3	.20
Devyatiny	15	.05	A4;E1	2	.05
Krasavino	10-50	.05	D4	2	.05
Sokol	30	.05	E3;03	3	.05
Velikiy Ustyug/ Galuzino	40	.10	D4;E1;M1	2	.10
Vologda	127	.25	A4;D4;L1;03	2	.25
NORTHWEST REGION--6.55 percent of total Soviet manufacturing; population in the 55 centers considered averages 55,000 per .05 percent of Soviet manufacturing*					
Karel'sk ASSR					
Belomorsk	10-50	.05	A5;E1;M4	2	.05
Petrozavodsk	118	.15	A5;E1;L1;04	2	.15
Sortavala	25	.05	E1,3	2	.05
Kaliningrad Oblast					
Kaliningrad	188	.25	A1;E2,5;L1;M4	2	.25
Sovetsk	50	.05	83	2	.05
Leningrad Oblast					
Leningrad****	3,182	4.50	A1;D1;J1;K1;L1,2, 5,6; M1;N1;01;R1	3	4.90
Luga	40	.05	04	2	.05
Podporozh'ye	10-50	.05	E2;52	2	.05
Priozersk	30	.05	E1,3	2	.05
Tikhvin/ Boksitogorsk	35	.05	E1;08	2	.05
Volkhov	40	.05	J2;52	3	.05
Vyborg	51	.05	E1;K1;L3	2	.05
Murmansk Oblast					
Kandalakhsha	35	.05	E1;J2;52	2	.05
Kirovsk	10-50	.05	H3;04	3	.05
Murmansk	168	.25	A5;D7;E2;L1;M4	2	.20
Novgorod Oblast					
Borovichi	40	.05	E1;L1	2	.05
Chudovo/ Krasnofarfornyy	10-50	.05	E2;Q2,4	2	.05
Novgorod	50	.05	A1;E1	2	.05
Parakhino-Peddub'ye	10-50	.05	A5;D7;E2,3	2	.05
Pskov Oblast					
Pskov	69	.10	A1;F3;L1	2	.10
CENTRAL REGION--23.30 percent of total Soviet manufacturing; population in the 178 centers considered averages 52,500 per .05 percent of Soviet manufacturing*					
Belashov Oblast					
Belashov	56	.10	A2,3	2	.10
Borisoglebsk	55	.10	A1	2	.10
Rtishchevo	30	.05	A1,7;04	2	.05
Belgorod Oblast					
Belgorod	40	.05	A1;L1;Q1	2	.05
Stariy Oskol	10-50	.05	A2;01	2	.05
Bryansk Oblast					
Bryansk	185	.30	A1,3;H3;L1,3; M1,3;Q5	3	.35
Klintsy	40	.05	D1;L1	2	.05
Novozybkov	35	.05	A6;E2	2	.05
Chuvash ASSR					
Alatyr'	40	.05	D1;E2;M1	3	.05
Cheboksary	63	.10	D2;L1	2	.10
Kanash	35	.05	A3;M1	2	.05
Gor'kiy Oblast					
Arzamas	39	.05	A1	2	.05
Balakhna	30	.05	E1;F3;51	3	.05
Bogorodsk	30	.05	C1;F3	2	.05
Dzerzhinsk	147	.25	A2;F3;01	3	.25
Gor'kiy	876	1.35	A1;K1;L1,5,6; M2,3	3	1.65
Kulebaki	30	.05	J1	2	.05
Pavlovo	35	.05	L1;M1	2	.05
Pravdinsk	10-50	.05	E3;52	3	.10
Vyksa	30	.05	J1;L1	2	.05
Ivanovo Oblast					
Furmanov	40	.05	D2	2	.05
Ivanovo	319	.50	A3;D2;L1	3	.55
Kineshma	84	.15	D2;E1;H3;04	2	.15
Kokhma	10-50	.05	D2,4	2	.05
Shuya	64	.10	D2,4;F3;L1;T2	2	.10
Teykovo	10-50	.05	D2;F3	2	.05
Vichuga	51	.10	D2;L1	2	.10
Kalinin Oblast					
Bezhetsk	30	.05	D4;K1;L1	2	.05
Kalinin	240	.35	A1;D1;K1;M1;01	3	.40
Kimry	30	.05	C1;K1;L1	2	.05
Rzhev	50	.10	A8;D4;K1;L1	1	.05
Torzhok	30	.05	C1;K1;L1	2	.05
Vyshniy Volochek	60	.10	D1;F3;K1;L1;Q2	2	.10
Kaluga Oblast					
Borovsk	10-50	.05	D3	2	.05
Kaluga	122	.20	A1;E2;K1;L6;M1	2	.20
Lyudinovo	10-50	.05	K1;L3	2	.05
Kirov Oblast					
Kirov	211	.30	A5;E2;K1;L1	2	.35
Kirs/ Rudnichnyy	15	-	H3;J1	3	.05
Kotel'nich	10-50	.05	E1	2	.05
Omutinsk	10	-	J1	3	.05
Slobodskoy	40	.05	C1;E2	2	.05
Kostroma Oblast					
Buy	30	.05	E1	2	.05
Kostroma	156	.25	A1;C1;D4;E1; K1;L1	2	.25
Nerekhta	30	.05	D4;E2;F3	2	.05
Shar'ya	30	.05	E2	2	.05
Kursk Oblast					
Kursk	179	.30	A1;E2;L5,6;01	2	.30

Center	Population in 000's	Magnitude of Manufacturing as Figured in Direct Proportion to Population*	Type of Manufacturing Activity**	Relative Importance of Manufacturing in Economy***	Estimated Magnitude of Manufacturing
Lipetsk Oblast					
Lipetsk	125	.20	G1;J1;L3	3	.25
Yelets	60	.10	A1;K1,L1;T2	2	.10
Mariy ASSR					
Ioshkar-Ola	73	.10	A3,4;E1;K1;L1	2	.10
Volzhsk	10-50	.05	E1,3	2	.05
Mordov ASSR					
Ruzayevka	30	.05	A1;F3;K1;L1	2	.05
Saransk	66	.10	A4;L3,6	2	.10
Moscow Oblast					
Dmitrov	10-50	.05	K1;L1	2	.05
Elektrostal'	88	.15	J1	3	.15
Ivanteyevka	10-50	.05	D2,3	3	.10
Klin	10-50	.05	D3	2	.05
Kolomna	94	.15	K1;L1,2,6;M3	3	.20
Lyubertsy	81	.10	L3	3	.15
Moscow****	5,551	8.25	A1;D1;E2;K1;L1;M2,3,4;O1;R1	2	8.20
Mytishchi	91	.15	D1;M1	3	.20
Noginsk	99	.15	D1	2	.15
Orekhovo-Zuyevo	109	.15	D2,6;O1;Q2	3	.20
Pavlovskiy Posad	52	.10	D1	3	.10
Podol'sk	115	.15	K1;L1,2;O1	3	.20
Pushkino	10-50	.05	D3	2	.05
Serpukhov	102	.15	D2;E3;M6	3	.20
Shatura	50	.10	F3;S1	1	.05
Shchelkovo	10-50	.05	D1;O1	3	.10
Staraya Kuperna	10-50	.05	D3	2	.05
Stupino	40	.05	K1;L1;M3;S1	3	.10
Voskresensk	10-50	.05	O1;Q4	3	.10
Yegor'yevsk	59	.10	D2;K1;L1	2	.10
Zagorsk	72	.10	D1;T1	2	.10
Orel Oblast					
Livny	10-50	.05	A1;L1	2	.05
Orel	128	.20	A1;C1;D7;E2,K1;L1,5	2	.20
Penza Oblast					
Kuznetsk	60	.10	C1;K1;L1	2	.10
Penza	231	.35	A1;E3;K1;M1	2	.35
Serdobsk	10-50	.05	K1;L1	2	.05
Ryazan' Oblast					
Kasimov	30	.05	D7;G1;K1;O1	2	.05
Ryazan'	156	.20	A3,6;K1;M1,3	3	.25
Skopin	10-50	.05	F2;K1;L1	2	.05
Smolensk Oblast					
Roslavl'	35	.05	A4;K1;L1;Q2	2	.05
Smolensk	151	.20	A3,4;D4;E2;K1;L1	2	.20
Vyazma	30	.05	A1;K1;L1	3	.05
Yartsevo	30	.05	D2	2	.05
Tambov Oblast					
Kirsanov	10-50	.05	K1;L1	2	.05
Michurinsk	75	.10	A1,3;L1;M3	2	.10
Morshansk	40	.05	D3,7;F3	2	.05
Tambov	150	.25	A1;L1,6;M3,5;O2,3	2	.25
Tula Oblast					
Kosaya Gora	10-50	.05	J1	3	.05
Shchekino	30	.05	F2;Q4	2	.05
Stalinogorsk	109	.15	F2;L1;O2,4;Q1;S1	3	.20
Tula	320	.50	F2;J1;K1;L1,3;M1	3	.55
Uzlovaya	55	.10	F2	2	.05
Velikiye Luki Oblast					
Velikiye Luki	53	.10	K1;L1	1	.05
Vladimir Oblast					
Aleksandrov	25	.05	D2;K1;L6	2	.05
Gus'-Khrustal'nyy	40	.05	F3;Q2	2	.05
Kirzhach	10-50	.05	D3;L6	3	.05
Kol'chugino	40	.05	J5;K1;L1	2	.05
Kovrov	90	.15	A3;D2;L4;M6	3	.15
Murom	64	.10	D2;K1;M3,4	2	.10
Sobinka	10-50	.05	D2	2	.05
Vladimir	121	.20	D2;K1;L3;M1;O1	3	.25
Vyazniki	40	.05	D4	2	.05
Voronezh Oblast					
Buturlinovka	10-50	.05	A2	2	.05
Voronezh	400	.60	A1;L1;M3;O5;P1;Q4	2	.65
Yaroslavl' Oblast					
Yaroslavl'-Zelenskiy	30	.05	D1	2	.05
Rostov	30	.05	A6;D4	2	.05
Rybinsk	162	.25	A2;E1;L1;M4;S2	3	.30
Uglich	30	.05	K1;S2	2	.05
Yaroslavl'	374	.60	D2;L1;M2;O5;P1	3	.65
VOLGA REGION--5.35 percent of total Soviet manufacturing; population in the 27 centers considered averages 44,000 per .05 percent of Soviet manufacturing*					
Astrakhan' Oblast					
Astrakhan'	276	.40	A4,6;M4	1	.25
Kuybyshev Oblast					
Chapayevsk	78	.10	L3	2	.10
Kuybyshev	760	1.10	A1;K1;L1,3,5;O5	3	1.25
Pokhvistnevo	10-50	.05	F4,5	2	.05
Stavropol'	30	.05	F4	2	.05
Syzran'	169	.25	A1;F6;L3;M3;Q2	3	.25
Saratov Oblast					
Balakovo	10-50	.05	A1;L1	2	.05
Engel's	79	.10	A3;L1	2	.10
Marks	10-50	.05	L1	2	.05
Saratov	518	.75	A1;L1;O5	2	.80
Vol'sk	60	.10	Q3	1	.05
Stalingrad Oblast					
Kamyshin	35	.05	A1	2	.05
Stalingrad	525	.75	A1;E1;J1;L4;O5	3	.90
Tatar ASSR					
Bugul'ma	53	.10	A2;F4	1	.05
Chistopol'	35	.05	L1	2	.05
Kazan'	565	.85	C1;D1;L1,3;M3,5;O1,6;P1	3	.95
Zelenodol'sk	57	.10	K1;M4	2	.05
Ul'yanovsk Oblast					
Ul'yanovsk	183	.25	A1;K1;L1;M2	3	.30
NORTH CAUCASUS REGION--4.45 percent of total Soviet manufacturing; population in the 52 centers considered averages 38,500 per .05 percent of Soviet manufacturing*					
Chechen-Ingush ASSR					
Groznyy	226	.30	A1,5,7;F4;L5;O5	3	.35
Dagestan ASSR					
Derbent	35	.05	A7;D1;P5;Q2	2	.05
Makhachkala	106	.15	A3,5;D1;L1;O5	2	.15
Kabardino-Balkar ASSR					
Nal'chik	72	.10	A1;D3;L1;Q4	2	.10

Center	Population in 000's	Magnitude of Manufacturing as Figured in Direct Proportion to Population[a]	Type of Manufacturing Activity[aa]	Relative Importance of Manufacturing in Economy[aaa]	Estimated Magnitude of Manufacturing
Kamensk Oblast					
Kamensk-Shakhtinskiy	59	.10	E1;F1;O2	3	.10
Koksovyy	10-50	.05	F1	3	.05
Krasnyy Sulin	60	.10	J1	3	.10
Likhovskoy	10-50	.05	F1;L1	2	.05
Novoshakhtinsk	95	.10	F1	3	.15
Shakhty	180	.25	C1;D1;F1;S1	3	.30
Krasnodar Kray					
Apsheronsk	10-50	.05	F4	3	.05
Armavir	102	.15	L3;O6	2	.15
Krasnodar	271	.35	A1;D3;L1,6;O5	2	.40
Kropotkin	51	.05	A8;O6	2	.05
Maykop	77	.10	A1;E1	2	.10
Novorossiysk	79	.10	A1;L1;Q3	2	.10
Sochi	84	.10	A3,4,7	1	.05
Tikhoretsk	10-50	.05	A1;L1	2	.05
Tuapse	40	.05	L1;O5	2	.05
Yeysk	56	.05	A1,5;L1	2	.05
North Ossetian ASSR					
Alagir	10-50	.05	E2;L1	2	.05
Ordzhonikhidze	159	.20	A6;J5;L1;S2	2	.20
Rostov Oblast					
Novocherkassk	90	.10	A7;K1;L1	3	.15
Rostov	552	.75	A1;B1;C1;L3,5; M4,5	3	.85
Taganrog	189	.25	J1;L1,3	3	.30
Stavropol' Kray					
Budennovsk	10-50	.05	A2,7;D1	2	.05
Cherkessk	25	.05	A1;L1	2	.05
Georgiyevsk	10-50	.05	A1;L1	2	.05
Kislovodsk	58	.10	A1;S1	1	.05
Pyatigorsk	69	.10	A2;L6	1	.05
Stavropol'	123	.15	A2,3;C1;L1; O1,6	3	.20
URALS REGION--12.70 percent of total Soviet manufacturing; population in the 109 centers considered averages 27,000 per .05 percent of Soviet manufacturing[a]					
Bashkir ASSR					
Baymak	10-50	.05	O6;J3	3	.05
Belebey	10-50	.05	A1;F4	2	.05
Beloretsk	51	.10	J1;K1;L1	3	.15
Blagoveshchensk	10-50	.05	K1;L1	2	.05
Ishimbay	50	.10	F4;L1;O1,2;S1	3	.10
Oktyabr'skiy	63	.10	A1;F4	3	.10
Sterlitamak	50	.10	K1;L1;O1	3	.10
Tirlyanskiy	10-50	.05	J1	3	.05
Tuymazi	10-50	.05	A3;F4	3	.05
Ufa	471	.85	A1;D2;E2;K1;L2, 3,6;O5	3	.95
Chelyabinsk Oblast					
Asha	10-50	.05	J1;O5	3	.05
Chelyabinsk	612	1.15	J1,5;K1;L1,3,5; M5;O2	3	1.25
Karabash	35	.05	J5	2	.05
Kasli	10-50	.05	K1;L3	2	.05
Kopeysk	149	.30	F2;K1;L1	3	.30
Korkino	77	.15	F2	2	.10
Kusa	10-50	.05	K1;L1	3	.05
Kyshtym	50	.10	H7,8,9;J3,4	3	.10
Magnitogorsk	284	.55	G1;J1;K1;L1;O2	3	.65
Miass	50	.10	K1;L1;M2	3	.10
Plast	30	.05	Q4	2	.05
Satka	10-50	.05	G1,8,10;Q4	3	.05
Troitsk	68	.15	A3;C1;L1;O6	2	.10
Ust'-Katav	10-50	.05	M3	3	.05
Verkhniy Ufaley	30	.05	G5;J1,5	3	.05
Zlatoust	143	.25	E2;J1;K1;L3	3	.30
Orenburg Oblast					
Buguruslan	40	.05	A2;F4,5	2	.05
Buzuluk	52	.10	A2;L1	1	.05
Mednogorsk	10-50	.05	G6;J3	3	.05
Novo-Troitsk	25	.05	J1	3	.05
Orenburg	226	.40	A2,3;C1;K1; L1,2	2	.40
Orsk	157	.30	A3;G1,5;J3;L1; M3;O5	3	.55
Sol'-Iletsk	10-50	.05	F2;N2;O2	3	.05
Perm Oblast					
Berezniki	93	.15	A3;N2;J5;O2,4	3	.20
Chermoz	10-50	.05	J1	2	.05
Chusovoy	56	.10	J1	2	.10
Dobryanka	10-50	.05	J1	2	.05
Gubakha	50	.10	F1;K1;L1;O2;S1	3	.10
Kizel	10-50	.05	F1;S1	3	.05
Krasnokamsk	50	.10	E3;F4	3	.10
Krasnovishersk	10-50	.05	E3	3	.05
Kungur	60	.10	K1;L1	1	.05
Lys'va	66	.10	J1;K1;L1	3	.15
Perm	538	1.00	A1,3;K1;L1,2; M1,3;O2;S2	3	1.10
Solikamsk	30	.05	E3;N1;J5;O2,4	3	.05
Ugleural'sk	52	.10	F1	3	.05
Sverdlovsk Oblast					
Alapayevsk	30	.05	G1;J1;L1;S2	3	.10
Artemovskiy	10-50	.05	F1;O8	3	.05
Asbest	54	.10	N6;K1;L1;Q4	3	.10
Irbit	30	.05	E2;M1	2	.05
Ivdel'	40	.05	G1,2	3	.05
Kamensk-Ural'skiy	122	.25	G1,8;J1,2	3	.25
Karpinsk	40	.05	F2;S1	2	.05
Kirovgrad	30	.05	J5;O1	3	.05
Krasnotur'insk	62	.10	J2	2	.10
Krasnoufimsk	30	.05	A1;K1;L1	2	.05
Krasnoural'sk	30	.05	G6;J3	3	.05
Kushva	10-50	.05	J1	2	.05
Nizhnaya Salda	10-50	.05	J1;K1;L1	3	.05
Nizhnaya Tura	30	.05	J1	2	.05
Nizhniy Sergi	10-50	.05	J1	2	.05
Nizhniy Tagil	297	.55	A3;O1;J1;M1;O2	3	.65
Pervoural'sk	78	.15	J1	3	.15
Polevskoy	10-50	.05	J1;O2	3	.05
Revda	51	.10	G6;J3	3	.10
Severoural'sk	30	.05	G8	3	.05
Serov	93	.15	G1;J1	3	.20
Sukhoy Log	10-50	.05	Q4	2	.05
Sverdlovsk	707	1.30	A1;J1,3;K1;L2, 4,5,6;O2	3	1.45
Verkhnaya Pyshma	10-50	.05	J3	2	.05
Verkhnaya Salda	30	.05	K1;L1	3	.05
Udmurt ASSR					
Glazov	30	.05	E2;K1;L1	2	.05
Izhevsk	252	.45	A3;E2;J1;L3	2	.45
Kambarka	10-50	.05	K1;L1	2	.05
Sarapul	50	.10	C1;K1;L1	2	.10
Votkinsk	54	.10	E1;F3;K1;M3;O1	2	.10

Center	Population in 000's	Magnitude of Manufacturing as Figured in Direct Proportion to Population*	Type of Manufacturing Activity**	Relative Importance of Manufacturing in Economy***	Estimated Magnitude of Manufacturing
WESTERN SIBERIA REGION--5.45 percent of total Soviet manufacturing; population in the 56 centers considered averages 39,500 per .05 percent of Soviet manufacturing*					
Altay Kray					
Barnaul	255	.50	A2;D2;K1;L1	3	.35
Biysk	112	.15	A2,3,8;D4;L1	2	.10
Rubtsovsk	95	.10	L3,6	2	.10
Slavgorod	40	.05	A1	2	.05
Kemerovo Oblast					
Anzhero-Sudzhensk	116	.15	F1;K1;L1	3	.20
Belovo	67	.10	F1;J4	3	.10
Gur'yevsk	30	.05	J1	3	.05
Kemerovo	240	.30	F1;K1;L1;O2	3	.35
Kiselevsk	116	.15	F1;K1	3	.15
Leninsk-Kuznetskiy	119	.15	F1;K1;L1;O2	3	.20
Osinniki	74	.10	F1	3	.10
Prokop'yevsk	260	.35	A2;F1;K1	3	.35
Stalinsk	347	.45	F1;J1,2;K1;L1;M5;O3	3	.65
Tashtagol	10-50	.05	G1	3	.05
Kurgan Oblast					
Kurgan	106	.15	A2;O1;E2;L3	2	.15
Shadrinsk	40	.05	A2,4;K1;L1	2	.05
Novosibirsk Oblast					
Berdsk	10-50	.05	A2;L6	2	.05
Kuybyshev	30	.05	A1;K1;L1	2	.05
Novosibirsk	751	.95	A2;D1;J1;K1;L5;M2;O1,6	3	1.10
Tatarsk	40	.05	A1,4	2	.05
Omsk Oblast					
Omsk	505	.65	A2,3;D3;K1;L3;M5;O1	3	.65
Tomsk Oblast					
Kolpashevo	30	.05	A5;E1	2	.05
Tomsk	224	.30	A1;E2;K1;L6	2	.25
Tyumen' Oblast					
Ishim	55	.05	A1;K1;L1	2	.05
Tobol'sk	40	.05	E2;K1;ML	2	.05
Tyumen'	125	.15	E2;ML;O3	2	.15
EASTERN SIBERIA REGION--3.55 percent of total Soviet manufacturing; population in the 46 centers considered averages 50,500 per .05 percent of Soviet manufacturing*					
Buryat-Mongol ASSR					
Ulan-Ude	158	.25	A2,3;D3;K1;M1;J2	3	.25
Chita Oblast					
Borzya	10-50	.05	A5;M10	2	.05
Chita	162	.25	A5;C1;E1;F2;K1;M5	3	.25
Mogocha	10-50	.05	G11;J1	2	.05
Nerchinsk	10-50	.05	A1	2	.05
Nizhnaya Shakhtama	10-50	.05	G4;J5	3	.05
Olovyannaya	10-50	.05	G9;J5	3	.05
Petrovsk-Zabaykalskiy	30	.10	J1;J2	2	.10
Sretensk	10-50	.05	C1;ML	2	.05
Irkutsk Oblast					
Angarsk	90	.15	K1;L1;O2	2	.05
Bodaybo	10-50	.05	G11	2	.05
Bratsk	10-50	.05	E1;K1	2	.05
Cheremkhovo	124	.20	A1;F1;K1;L1	3	.20
Irkutsk	314	.50	A1;E1;K1;L1,4;M2;S2	3	.60
Kirensk	10-50	.05	ML	2	.05
Nizhneudinsk	10-50	.05	E1	2	.05
Tayshet	10-50	.05	E1	2	.05
Tulun	10-50	.05	A1;E1	2	.05
Usol'ye Sibirskoye	40	.05	E2;M2;O2;Q4	3	.05
Zima	10-50	.05	E1	2	.05
Krasnoyarsk Kray					
Abakan	40	.05	A5;E1	2	.05
Achinsk	55	.05	A2,5,4	2	.05
Bogotol	25	.05	A1;M8	2	.05
Chernogorsk	30	.05	F1	3	.05
Igarka	30	.05	E1	2	.05
Kansk	61	.10	A4;D2;E1;F2	2	.10
Krasnoyarsk	528	.55	A1;E1;K1;L5,4;M3;Q1	3	.60
Kyzyl	30	.05	A1;C1	2	.05
Minusinsk	40	.05	A1	2	.05
Noril'sk	92	.15	F1;05,6,15;J5	2	.10
Yeniseysk	10-50	.05	E1	2	.05
Yakut ASSR					
Al'dan	10-50	.05	G11	2	.05
Yakutsk	63	.10	A1;E1;F1	1	.05
FAR EAST REGION--3.15 percent of total Soviet manufacturing; population in the 41 centers considered averages 31,500 per .05 percent of Soviet manufacturing*					
Amur Oblast					
Blagoveshchensk	85	.15	A2;C1;E2;L5,4;M4	3	.15
Kuybyshevka-Vostochnaya	30	.10	A2	1	.05
Raychikhinsk	30	.05	F2;Q4	2	.05
Svobodnyy	55	.10	A1;K1;L1	2	.10
Kamchatka Oblast					
Petropavlovsk-Kamchatskiy	48	.10	A5;E1;K1;ML	1	.05
Khabarovsk Kray					
Bikin	10-50	.05	E1	3	.05
Birobidzhan	40	.05	D2;E2	2	.05
Khabarovsk	280	.45	A1;E1;K1;L5;M2,4,5;O5	3	.55
Komsomol'sk	169	.25	A1;E1;J1;K1;L1;ML,5	3	.35
Nikolayevsk	40	.05	A5;M4	2	.05
Sovetskaya Gavan'	60	.10	A5;E1	1	.05
Srednly Urgal (inc. suburbs)	10-20	-	F1	3	.05
Magadan Oblast					
Magadan	55	.10	L4;Q1	1	.05
Susuman	10-50	.05	G11	3	.05
Maritime Kray					
Artem	54	.10	E1;F2	2	.10
Chernigovka	10-50	.05	A2	2	.05
Nakhodka	54	.10	A5;E1	1	.05
Spassk-Dal'niy	10-50	.05	K1;L1	2	.05
Suchan	40	.05	E1;F1	3	.05
Tetyukhe	10-50	.05	G7,9;J4,5	3	.05
Ussuriysk	101	.15	A1;M1;O6	2	.15
Vladivostok	265	.40	A2,5;E1;K1;L4;ML	2	.45
Sakhalin Oblast					
Aleksandrovsk-Sakhalinskiy	30	.05	A5,E1;F1;L1	2	.05
Dolinsk	10-50	.05	E1,3	2	.05
Kholmsk	30	.05	A5;E1,3	2	.05
Korsakov	40	.05	A5;E1,3	2	.05
Krasnogorsk	10-50	.05	E1;L1	2	.05
Okha	30	.05	E1;M4	2	.05
Poronaysk	30	.05	A1;E3	2	.05
Uglegorsk	20	.05	A5;E3;F1	2	.05
Yuzhno-Sakhalinsk	79	.15	A1,3;E3;L1	2	.15

Center	Population in 000's	Magnitude of Manufacturing as Figured in Direct Proportion to Population*	Type of Manufacturing Activity**	Relative Importance of Manufacturing in Economy***	Estimated Magnitude of Manufacturing
UKRAINE--18.75 percent of total Soviet manufacturing; population in the 125 centers considered averages 50,000 per .05 percent of Soviet manufacturing*					
Cherkassy Oblast					
Cherkassy	50	.10	A6,8;D1	1	.05
Uman'	50	.10	A2;D1	1	.05
Chernigov Oblast					
Chernigov	60	.10	A1;D5;E1;O1	2	.10
Nezhin	50	.10	A1	1	.05
Novgorod-Severskiy	10-50	.05	M3;Q4	2	.05
Priluki	55	.05	A2,8;D1;E2	2	.05
Chernovtsy Oblast					
Chernovtsy	142	.25	A1;D2;E1;L1;O1	2	.20
Crimea Oblast					
Feodosiya	40	.05	A1;B1;L1	2	.05
Kerch'	120	.20	A1;G1;J1	2	.20
Sevastopol'	133	.20	A1;L6	1	.10
Simferopol'	159	.25	A1;B1;L1	1	.15
Yevpatoriya	40	.05	A2,5;D1	2	.05
Dnepropetrovsk Oblast					
Dneprodzerzhinsk	163	.25	J1;M5;O2	3	.30
Dnepropetrovsk	576	.95	A1;D1;J1;K1;L1	3	1.10
Krivoy Rog	322	.55	G1;J1	3	.65
Marganets	30	.05	G2	3	.05
Nikopol'	100	.15	J1;M4	3	.20
Pavlograd	30	.05	A2;E2	2	.05
Drogobych Oblast					
Borislav	40	.05	M4;H1,11	2	.05
Drogobych	50	.10	A1;E1;L1;O5;P1	2	.10
Khar'kov Oblast					
Izyum	30	.05	E1;K1;Q4	2	.05
Khar'kov	877	1.45	K1;L2,3,4,5,6;M3,6	3	1.65
Kupyansk	30	.05	A8;L1	2	.05
Kherson Oblast					
Kakhovka	10-50	.05	S2	1	.05
Kherson	134	.20	A6;L2;M4	2	.25
Khmel'nitskiy Oblast					
Kamenets-Podol'skiy	50	.10	A1;D1;L1	1	.05
Khmel'nitskiy	50	.10	A1;L1	1	.05
Kirovograd Oblast					
Aleksandriya	30	.05	A2;C1;F2	2	.05
Kirovograd	115	.20	A1;L3	2	.20
Kiyev Oblast					
Belaya Tserkov'	40	.05	A2	2	.05
Kiyev	991	1.65	A1;D1;K1;L3,5,6;M3,4,5,6;O1;P1	2	1.60
Lugansk Oblast					
Almaznaya	10	-	J1	3	.05
Irmino	10-50	.05	F1	3	.05
Kadiyevka	170	.30	F1;O2	3	.40
Krasnodon	10-50	.05	F1	3	.05
Krasnyy Luch	60	.10	F1	3	.10
Lisichansk	10-50	.05	O1;Q2	3	.05
Lugansk	251	.40	K1;L1,4;M3;Q4	3	.60
Rybezhnoye	50	.10	F1;O2	3	.10
Verkhneye	10-50	.05	F1;O2	3	.05
Voroshilovsk	75	.15	F1;J1;O2	3	.20
L'vov Oblast					
L'vov	387	.65	A1;D1;K1;L6;O5;Q2	2	.60
Nesterov	10-50	.05	M4;Q2	2	.05
Rava-Russkaya	10-50	.05	A5;P2	2	.05
Nikolayev Oblast					
Nikolayev	206	.35	A1;D1;L1;M4	2	.35
Pervomaysk	10-50	.05	A2,5;L5	2	.05
Odessa Oblast					
Belgorod-Dnestrovskiy	30	.05	A5,6	2	.05
Izmail	40	.05	A5;L1	1	.05
Odessa	607	1.00	A1,2;D1;L3,5;M4;O1,5	2	.95
Poltava Oblast					
Kremenchug	110	.20	A1;D5;K1;L1;M5	2	.15
Poltava	129	.20	A2,3;D2;L1	2	.20
Rovno Oblast					
Rovno	50	.10	A1;E1;L5	1	.05
Stalino Oblast					
Ambrosiyevka	10-50	.05	Q4	2	.05
Artemovsk	60	.10	H2;O2	3	.10
Chasov Yar	10-50	.05	Q4	2	.05
Chistyakovo	75	.15	F1	3	.15
Debal'tsevo	10-50	.05	K1;L1	2	.05
Druzhkovka	40	.05	K1;L1	3	.10
Gorlovka	240	.40	F1;K1;L1;O2	3	.55
Konstantinovka	125	.20	J1,5;O2	3	.25
Kramatorsk	117	.20	J1;K1;L1;Q4	3	.25
Makeyevka	311	.50	F1;J1	3	.65
Novo-Ekonomicheskoye	10-50	.05	F1	3	.05
Rutchenkovo	10-50	.05	F1;K1;L1;O2	3	.05
Slavyansk	80	.15	H2;O2	3	.20
Stalino	625	1.05	F1;J1;K1;L1;O2	3	1.30
Yenakiyevo	125	.20	F1;J1;O2	3	.25
Zhdanov	273	.45	A5;H8;J1;L1;M4	2	.50
Stanislav Oblast					
Kalush	10-50	.05	H1;O1	2	.05
Kolomyya	40	.05	D1;L1;O5	2	.05
Stanislav	70	.10	A1;C1;L1;O5	2	.10
Sumy Oblast					
Konotop	50	.10	A1;L1	2	.05
Romny	10-50	.05	A2;M4	1	.05
Shostka	30	.05	A5;O1	2	.05
Sumy	70	.10	A8;D2;K1;L1	2	.10
Ternopol' Oblast					
Ternopol'	40	.05	A1;L1;Q5	2	.05
Transcarpathian Oblast					
Mukachevo	30	.05	A5;E2	2	.05
Uzhgorod	40	.05	A1;E2	2	.05
Vinnitsa Oblast					
Kazatin	10-50	.05	A5,8;N9	2	.05
Mogilev-Podol'skiy	40	.05	A1;E1;K1	2	.05
Vinnitsa	105	.20	A5;L1;O4	2	.20
Volyn' Oblast					
Lutsk	30	.05	A1;D1;E1	2	.05
Zaporozh'ye Oblast					
Bolshoy Tokmak	10-50	.05	K1;L1	2	.05
Melitopol'	110	.20	A2;E2;L1	2	.20

Center	Population in 000's	Magnitude of Manufacturing as Figured in Direct Proportion to Population*	Type of Manufacturing Activity**	Relative Importance of Manufacturing in Economy***	Estimated Magnitude of Manufacturing
Cuipenko	70	.10	A5;L1;M4,5	2	.10
Zaporozh'ye	581	.65	J1,2;K1;L3;O1;S2	3	.75
Zhitomir Oblast					
Berdichev	70	.10	A1;B1;D1	2	.10
Korosten'	30	.05	E1,3;O1;Q2	2	.05
Novograd-Volynskiy	30	.05	A1;E1,2	2	.05
Zhitomir	110	.20	A1;E1,2	2	.15
MOLDAVIA--.45 percent of total Soviet Manufacturing; population in the 8 centers considered averages 43,000 per .05 percent of Soviet manufacturing*					
Bel'tsy	60	.05	A8;L1;O6	2	.05
Bendery	30	.05	A6	2	.05
Kishinev	190	.20	A1;C1;D1;K1;Q5	2	.25
Orgeyev	10-50	-	A1,7;B1;Q4;T2	2	.05
Tiraspol'	50	.05	A2,6,7;L1	2	.05
BELORUSSIA--2.10 percent of total Soviet manufacturing; population in the 26 centers considered averages 94,500 per .05 percent of Soviet manufacturing*					
Brest Oblast					
Baranovichi	60	.10	A4;C1;Q2,5	2	.10
Brest	60	.10	C1;D2;E1;K1	2	.10
Pinsk	30	.05	C1;E2	2	.05
Gomel' Oblast					
Gomel'	144	.20	E1;L3,5,6;Q2,4	3	.25
Mozyr'	20	.05	E1,2	2	.05
Rechitsa	30	.05	E2	2	.05
Grodno Oblast					
Grodno	60	.10	A1;B1;D4;K1	2	.10
Lida	20	.05	L5;P1;Q2,3,4	2	.05
Minsk Oblast					
Borisov	45	.05	E2;O3;Q2	2	.05
Minsk	412	.60	A1;D1;K1;L3,6;M2	2	.70
Mogilev Oblast					
Bobruysk	100	.15	D1;E2;K1	1	.10
Mogilev	80	.10	C1;D6;E2;P5;L5	3	.15
Vitebsk Oblast					
Orsha	40	.05	D4;L5	2	.05
Polotsk	30	.05	A3;D2;K1	2	.05
Vitebsk	128	.20	B1;D1;E2;L3;M1	3	.25
ESTONIA--.70 percent of total Soviet manufacturing; population in the 9 centers considered averages 32,500 per .05 percent of Soviet manufacturing*					
Kokhtla-Yarve	30	.05	E3;P6;O1	3	.05
Narva	20	.05	A1,5;D2,3,4	2	.05
Pyarnu	30	.05	A5;D2,4;E2	2	.05
Rakvere	10-50	.05	A3;C1;D4	2	.05
Tartu	60	.10	D4;K1;L5;Q2	2	.10
Tallin	257	.40	A2,5;D1;E2;L6;M4	2	.55
Valga	10-50	.05	A1;D1	2	.05
LATVIA--.95 percent of total Soviet manufacturing; population in the 7 centers considered averages 41,000 per .05 percent of Soviet manufacturing*					
Daugavpils	50	.05	A1;E2;K1	2	.05
Liyepaya	80	.10	A5,6;J1;L1;M2;O1	2	.10
Riga	565	.70	A1;D1;K1;L1,6;M1,4;O1,Q1	2	.75
Yelgava	30	.05	A8;D4	2	.05
LITHUANIA--.70 percent of total Soviet manufacturing; population in the 6 centers considered averages 43,000 per .05 percent of Soviet manufacturing*					
Kaunas	195	.25	A1;D1;P3;K1;O1;P1	2	.25
Klaypeda	60	.05	A5;D1;E2;O4	2	.05
Panevezhis	60	.05	A1;D1;K1;O1	2	.05
Shyaulyay	75	.10	A5,4;C1;D4;L1	2	.10
Vil'nyus	200	.25	A1;E2;K1;L3,5,6;O4	2	.25
GEORGIA--1.45 percent of total Soviet manufacturing; population in the 19 centers considered averages 41,000 per .05 percent of Soviet manufacturing*					
Akhaltsikhe	10-50	-	P2;S2	3	.05
Batumi	70	.10	A1,7;K1;L1;O5;S1	1	.10
Chiatura	20	-	Q2	3	.05
Kutaisi	114	.15	A6;D1;M5;M2;O1;S2	3	.20
Rustavi	50	.05	A1;J1	3	.10
Sukhumi	50	.05	A1;B1;S2	1	.05
Tbilisi	635	.75	A1;C1;D3,5;L1,4	2	.75
Tkvarcheli	20	-	F1;S1	3	.05
Zestafoni	10-50	-	A1;J1	3	.10
AZERBAYDZHAN--2.05 percent of total Soviet manufacturing; population in the 14 centers considered averages 50,000 per .05 percent of Soviet manufacturing*					
Baku (inc. suburbs)	901	1.50	A1;D1;F4;K1;L1;O5	3	1.60
Deshkesan	10-50	.05	G1,8;M4	3	.05
Kirovabad	111	.20	A1;D2,3;H5	2	.15
Kuba	10-50	.05	A6;D8	2	.05
Lenkoran'	10-50	.05	A5,6,7;E1	2	.05
Mingechaur	10-50	.05	S2	2	.05
Nakhichevan'	30	.05	A1;H1	2	.05
Sumgait	10-50	.05	J1;L1	3	.05
ARMENIA--.65 percent of total Soviet manufacturing; population in the 6 centers considered averages 44,000 per .05 percent of Soviet manufacturing*					
Alaverdi	10-50	-	G6;J3;O1	3	.05
Kafan	10-50	-	G6;J3	3	.05
Kirovakan	45	.05	D8;O1	2	.05
Leninakan	103	.10	A1,2,5;D2	2	.10
Yerevan	385	.40	A1;B1;C1;D5;L1;O1	2	.40
KAZAKHSTAN--1.00 percent of total Soviet manufacturing; population in the 41 centers considered averages 44,500 per .05 percent of Soviet manufacturing*					
Akmolinsk Oblast					
Akmolinsk	80	.10	A2,3,4;L3;Q1	2	.10
Atbasar	30	.05	A2,3	2	.05
Aktyubinsk Oblast					
Aktyubinsk	66	.05	A2,3;J1;L1	3	.10
Alma-Ata Oblast					
Alma-Ata	350	.40	A1;D3;E2;K1;L1;Q1,4	2	.40
Dzhambul Oblast					
Dzhambul	90	.10	A6,8;O1	2	.10
East Kazakhstan Oblast					
Leninogorsk	70	.10	G7;J4;S2	3	.10
Ust'-Kamenogorsk	125	.15	A1;G9;J4,5;S2	3	.15
Zyryanovsk	50	.05	G7,12	3	.05
Gur'yev Oblast					
Dossor/ Kul'sary	10-50	-	F4	3	.05
Gur'yev	86	.10	A3,5;L1;O5	2	.10
Karaganda Oblast					
Balkhash/ Kounradskiy	60	.05	G6;M2;J3;S1	3	.10
Dzhezkazgan	30	.05	G2,6;J3	3	.05
Karaganda	350	.40	A1;F1;L1,4	3	.50
Saran'	40	.05	F1	3	.05
Temir-Tau	50	.05	J1;O1	3	.10

Center	Population in 000's	Magnitude of Manufacturing as Figured in Direct Proportion to Population*	Type of Manufacturing Activity**	Relative Importance of Manufacturing in Economy***	Estimated Magnitude of Manufacturing
Kokchetav Oblast					
Kokchetav	40	.05	A2,3;C1;L1	2	.05
Shchuchinsk	35	.05	A1;Q1	2	.05
Kustanay Oblast					
Kustanay	60	.05	A2,3,4;C1;D3;L1	2	.05
Rudnyy	40	.05	Q1	3	.05
Kzyl-Orda Oblast					
Kzyl-Orda	50	.05	A1	1	.05
North Kazakhstan Oblast					
Petropavlovsk	118	.15	A2,3;L3	2	.15
Pavlodar Oblast					
Pavlodar	60	.05	A2,3;N2;L1	2	.05
Semipalatinsk Oblast					
Semipalatinsk	136	.15	A1;D3;N2;L1	2	.15
South Kazakhstan Oblast					
Chimkent	130	.15	A1;M4;L1	2	.15
Kentau	30	.05	Q7	3	.05
Lenger	25	.05	F1,2;Q4;S1	3	.05
Taldy-Kurgan Oblast					
Tekeli	30	.05	Q7;M4	2	.05
West Kazakhstan Oblast					
Ural'sk	87	.10	A2,3;C1;L1	2	.10
UZBEKISTAN--1.65 percent of total Soviet manufacturing; population in the 28 centers considered averages 55,000 per .05 percent of Soviet manufacturing*					
Andizhan Oblast					
Andizhan	115	.10	A1;D2;M4;L1	2	.10
Bukhara Oblast					
Bukhara	60	.05	A1;C1;D5	1	.05
Fergana Oblast					
Fergana	60	.05	A1;D2,5,8;S1	2	.05
Kokand	75	.05	D2,5,8;Q1	3	.10
Margelan	45	.05	D2,5,8	2	.05
Kashka-Dar'ya Oblast					
Karshi	30	.05	A2,7;D2;K1	2	.05
Namangan Oblast					
Namangan	104	.10	A1;D2,5	2	.10
Samarkand Oblast					
Katta-Kurgan	45	.05	A3;D2;Q6	2	.05
Samarkand	170	.15	A6,7;C1;D2,5;L1	2	.15
Tashkent Oblast					
Angren	30	.05	F2;N9	3	.05
Begovat	30	.05	J1;S2	3	.05
Chirchik	45	.05	Q1;S2	3	.05
Tashkent	778	.70	A1;C1;D2;K1;L1,5	2	.80
TURKMENISTAN--.45 percent of total Soviet manufacturing; population in the 12 centers considered averages 49,500 per .05 percent of Soviet manufacturing*					
Ashkhabad Oblast					
Ashkhabad	142	.15	A1;D1,8;L1;Q1	2	.15
Chelekan	10-50	-	F4;Q1	3	.05
Krasnovodsk	40	.05	D1;L1;Q5	2	.05
Kum-Dag	10-50	-	F4;H11	3	.05
Nebit-Dag	40	.05	F4;N2	3	.05
Chardzhou Oblast					
Chardzhou	60	.05	A6;D2,5;K1;M4	2	.05
Mary Oblast					
Mary	50	.05	A1;D2,3,8;K1	2	.05
KIRGIZIYA--.45 percent of total Soviet manufacturing; population in the 14 centers considered averages 50,000 per .05 percent of Soviet manufacturing*					
Dzhalal-Abad Oblast					
Dzhalal-Abad	30	.05	A1;B1;D2;F4;K1	2	.05
Frunze Oblast					
Frunze	190	.20	A2,3,6;D3;K1;L3	2	.20
Tokmak	25	.05	A8;D1;K1	2	.05
Issyk-Kul' Oblast					
Przheval'sk	30	.05	A2,7;L1;06	2	.05
Osh Oblast					
Kyzyl-Kiya	25	.05	P2	2	.05
Osh	40	.05	A3;B1;D5;K1	2	.05
TADZHIKISTAN--.30 percent of total Soviet manufacturing; population in the 8 centers considered averages 55,000 per .05 percent of Soviet manufacturing*					
Isfara	10-40	-	A1;F1,4	2	.05
Kanibadam	10-40	-	A1;F4;K1;06	2	.05
Leninabad	60	.05	A1;D2,5,8	2	.05
Stalinabad	191	.15	A3;C1;D2,5;K1;L5	2	.15

*The first step in the estimating process was to distribute manufacturing among the centers considered (centers with a population of at least 10,000 and which contain reasonable amounts of manufacturing) in direct proportion to their population. For example, in the North Region the combined population of the 25 centers is approximately 975,000. Since the region possesses 2.05 per cent of total Soviet manufacturing, this indicates an average of about 24,000 persons for each .05 per cent (the smallest unit of measurement thought practicable for use in this study). In this initial step Arkhangel'sk, with 236,000 persons, received a magnitude of $\frac{236,000}{24,000}$ x .05 or .50.

**Soviet manufacturing is classified according to type of activity, and includes mining, generation of electric power, lumbering, and fishing. Designations in the table are as follows:

A--Food Products
1--General (not specified)
2--Grain-mill
3--Meat
4--Dairy
5--Fish
6--Fruit
7--Beverage
8--Sugar

B--Tobacco Products
1--General (not specified)

C--Leather Products
1--General (not specified)

D--Textile Products & Clothing
1--General (not specified)
2--Cotton
3--Wool
4--Linen
5--Silk
6--Rayon
7--Burlap
8--Rugs

E--Lumber & Wood Products
1--Lumber
2--Woodworking
3--Paper

F--Mining Power Resources
1--Coal
2--Lignite
3--Peat
4--Petroleum
5--Natural Gas
6--Oil Shale

G--Mining Metal Ores
1--Iron
2--Manganese
3--Chromium
4--Molybdenum
5--Nickel
6--Copper
7--Lead & Zinc
8--Aluminum (bauxite)
9--Tin
10--Magnesium
11--Gold
12--Silver
13--Platinum

H--Mining Nonmetallic Minerals
1--Potash
2--Salt
3--Phosphate
4--Sulphur
5--Barite
6--Asbestos
7--Mica
8--Graphite
9--Kaolin
10--Fluorospar
11--Ozocerite

J--Primary Metals Industries
1--Iron & Steel
2--Aluminum
3--Copper
4--Lead & Zinc
5--Other

K--Fabricated Metal Products
1--General (not specified)

L--Machinery
1--General (not specified)
2--Engines & Turbines
3--Tractors & Farm Machinery
4--Construction & Mining Machinery
5--Metalworking Machinery
6--Electrical Machinery & Equipment

M--Transportation Equipment
1--General (not specified)
2--Motor Vehicles
3--Railroad Equipment
4--Shipbuilding
5--Aircraft and Parts
6--Motorcycles & Bicycles

N--Instruments
1--General (not specified)

O--Chemicals & Allied Products
1--General (not specified)
2--Industrial
3--Wood Chemicals
4--Fertilizers
5--Petroleum Refining
6--Vegetable & Animal Oils

P--Rubber Products
1--General (not specified)

Q--Stone, Clay & Glass Products
1--General (not specified)
2--Glass
3--Cement
4--Ceramics

R--Printing & Publishing
1--General (not specified)

S--Generating Electric Power
1--Thermal
2--Hydro

T--Miscellaneous
1--Toys
2--Handicrafts
3--Other

***Estimated for each center on the basis of probable ratio of workers in manufacturing to total labor force:

3 -- Workers in manufacturing probably account for half or more of the center's total labor force;
2 -- Workers in manufacturing probably account for between a quarter and a half of the center's labor force;
1 -- Workers in manufacturing probably account for less than a quarter of the center's labor force.

****Includes Leningrad (2,819,000) and suburban centers Kolpino, Pushkin, Sestroretsk, and other centers subordinate to the Leningrad City Soviet. Includes Moscow (4,847,000) and suburban centers Babushkin (103,000), Kuntsevo (111,000), Lyublino (84,000), Perovo (132,000), and Tushino (74,000).

The Latvian city of Riga (.75) is significant for machinery, chemicals, and wood products. Voronezh (.65), the largest city in the central black earth agricultural region, is as would be expected noted for food processing. At the former Polish city of L'vov (.60) food processing and light machine industries have developed. Small dispersed centers commonly emphasize processing of agricultural products, lumber or minerals.

Other Manufacturing Areas

Slightly over one-fourth (27.7 per cent) of Soviet manufacturing is located outside of the Soviet Manufacturing Belt. Most of this is found in loosely defined zones of low concentration situated in the Caucasus, along the course of the Trans-Siberian Railway, and in Central Asia. Many of the centers owe their manufacturing importance to locally produced minerals or crops; others were born out of the Soviet desire for strategic decentralization of industry and regional economic self-sufficiency.

Two zones, the North Caucasus and Transcaucasus, together account for 6.10 per cent of the country's manufacturing, and lie on opposite sides of the Caucasus Mountains. Processing of local agricultural products, extraction and refining of petroleum, machine building, textiles, and metal working are outstanding. Production for the local region predominates. Krasnodar (.40), noted for food processing, oil refining, and machinery, and Grozny (.35), which emphasizes oil refining, machinery, and food processing are the leading centers of the North Caucasus zone. Major centers in the Transcaucasus zone are Baku (1.60) with its oil extraction and refining, machine, textile, and food industries; Tbilisi (.75), a food, machinery, and textile center; and Yerevan (.40), with its machine, chemical, food, and textile industries. The rate of industrial growth in these two zones has been considerably slower than in the USSR as a whole, a situation which will probably continue with the decline in the relative importance of the area's petroleum production.

The Kuznetsk Basin-Novosibirsk zone has the second greatest magnitude (4.05) of the outlying zones and by far the highest degree of concentration. Originally based on coal and representing the eastern partner in the former Kuznetsk-Magnitogorsk Metallurgical Combine, the area has always been known for its heavy industry. It has grown rapidly since the 1930's. In addition to being based on coking-quality coal, a location astride major rail and water routes, the newly developed local iron ore deposits, and a proximity to fertile and expanding agricultural lands (the New Lands Program immediately to the southwest) have been important. Novosibirsk (1.10) is the largest manufacturing center east of the Soviet Manufacturing Belt. Although highly diversified, it is best known for iron and steel, machinery, chemicals, and mill products. In the highly industrialized Kuzbas (Kuznetsk Basin) are the heavy industry centers of Stalinsk (.65), Prokop'yevsk (.35), Kemerovo (.35) and several smaller centers. Ore processing, iron and steel, heavy machinery, and chemicals predominate. Barnaul (.35), south of Novosibirsk, is a producer of machines and flour.

The Central Asia zone accounts for 2.65 per cent of the USSR total. Here the processing of agricultural products, extraction and processing of mineral deposits, machine construction, textiles, and metalworking are most important. Like in the Caucasus, production for the local regional markets predominates.

Tashkent (.80), and Alma-Ata (.40) are the major centers. Continued industrial development should accompany the expansion of irrigated land and further exploitation of known mineral deposits.

The Far East zone has but 1.85 per cent of the Soviet Union's manufacturing. Industries are primarily concerned with the processing of local raw materials for local needs as part of the Soviet program for regional economic self-sufficiency. Major centers include Khabarovsk (.55), machinery, oil-refining, food, and lumber; Vladivostok (.45), machinery, shipbuilding, fish canning and other food; and Komsomol'sk (.35), ferrous metallurgy, shipbuilding, machinery, and food. Industrial growth has lagged behind the USSR average.

The Lake Baykal zone has 1.35 per cent of the nation's manufacturing. Industries are dependent on local mineral and agricultural resources. They supply equipment for Eastern Siberian mines, agriculture, and transport facilities, and provide manufactured food products for the population of the region. The most important centers are Irkutsk (.60), machinery, automobiles, lumber, and food; Ulan-Ude (.25), food, wool cloth, and machinery; and Cheremkhovo (.20), coal mining and machinery. Industrial growth is likely to continue at a rapid rate due to excellent power resources including both Cheremkhovo coal deposits and local hydroelectric projects.

A number of isolated manufacturing cities are situated outside the Soviet Manufacturing Belt and even far from the outlying zones. Among some of the more important of these are Omsk (.65), food and machinery; Krasnoyarsk (.60), machinery, food, lumber; Karaganda (.50), coal mining, and machinery; and Arkhangel'sk (.45), lumber and shipbuilding.

The map of manufacturing presented here, although based on a combination of quantitative measurement and qualitative judgment, is more complete and detailed than has heretofore been available. It shows the relative importance of individual manufacturing centers and substantiates the existence of previously described zones of industrial concentration. The pattern of manufacturing exhibited seems to justify reference to a Soviet Manufacturing Belt. Furthermore, the statistical and descriptive sources cited, and techniques of using these sources to produce the map, may serve as an aid to those concerned with the Soviet economy.

THE HARD CORE OF CAPE TOWN'S CENTRAL BUSINESS DISTRICT: AN ATTEMPT AT DELIMITATION

D. Hywel Davies

Mr. Davies, senior lecturer in geography in the University of Cape Town, has been engaged in studies of central Cape Town since 1956. In an article appearing in the October, 1959, issue of this magazine he discussed problems of delimiting the CBD and pointed out the value of studying the District's boundary.

IN the heart of Cape Town's Central Business District (CBD)[1] the intensification of central business functions, higher land values, heavier traffic, and generally taller buildings all indicate the presence of a "Hard Core." While such a feature is normal to western-type cities, comparatively little work appears to have been done on the problem of delimiting these core areas. As part of the wider task of establishing a framework within which to study the internal structure of the City's CBD, it became necessary, therefore, to devise a method of Hard Core delimitation for Cape Town. This article describes the way in which this problem was approached and a method finally evolved. As the study was carried out as a means to an end and based upon data for one city only it should be considered as no more than a step in the general direction of Hard Core delimitation. Nevertheless, it is hoped that the approach described and the limiting values proposed will be a contribution to the comparative studies which must necessarily precede any definitive method of delimitation.

[1] See D. Hywel Davies: "Boundary Study as a Tool in CBD Analysis: An Interpretation of Certain Aspects of the Boundary of Cape Town's Central Business District," *Econ. Geog.*, Vol. 35, 1959, pp. 322–345. This and the present article present the first results of a much wider study of Cape Town's CBD.

With comparisons in mind, it should be noted at the outset that Greater Cape Town, with a population of some 700,000, is larger than many cities where delimitation studies of central areas have been attempted:[2] as a provincial and national (legislative) capital, a major port and marketing center, and the home of important and diverse secondary industries it also provides an extremely wide range of urban functions.[3] The scale and diversity of these functions are reflected in the size and maturity of the CBD and its Hard Core, and the delimitation techniques described below may well be ineffective in urban centers greatly different from Cape Town in size, function, and general character. If they provide some basis for further discussion, however, this article will have served its purpose.

[2] Notably Raymond E. Murphy and J. E. Vance, Jr.: "Delimiting the CBD," *Econ. Geog.*, Vol. 30, 1954, pp. 189–222, and "A Comparative Study of Nine Central Business Districts," *Econ. Geog.*, Vol. 30, 1954, pp. 301–336, which deal with cities with "urbanized area" populations ranging from 107,000 to 227,000 in 1950.

[3] See W. J. Talbot: "Town and Country: Past and Present" in *The Cape Peninsula*, edited by J. A. Mabbutt, Cape Town, Maskew Miller, 1952; Peter Scott: "Some Functional Aspects of Cape Town," *Econ. Geog.*, Vol. 30, 1954, pp. 347–363; W. J. Talbot: "Kapstadt als Weltstadt," *Zum Problem Der Weltstadt* (Festschrift zum 32, Deutschen Geographentag in Berlin, May, 1959. Edited by Joachim H. Schultze.) Berlin, 1959.

GENERAL PRINCIPLES OF DELIMITATION

The Hard Core is that area which displays central business characteristics in their purest form—it is the quintessence of the CBD. The difference between the Hard Core and the CBD is therefore one of degree, not one in kind: the one is the heart of the other. It follows that Hard Core delimitation should be based upon criteria essentially similar to those used in CBD delimitation, although obviously with limiting values higher on any chosen scale. Almost certainly the best method of CBD delimitation so far devised—at least from the standpoint of the urban geographer—is the Central Business Index (CBI) method of Murphy and Vance.[4] With only minor variations, this was the method used by the present author in Cape Town, the resultant boundary being shown in Figures 2, 3, and 4. It was decided at the outset that Hard Core delimitation should be based upon this method, but with the adoption of "stiffer" limiting values. Inclusion of a block within the Hard Core or its exclusion from it would thus depend upon its Central Business Height Index (CBHI) and Central Business Intensity Index (CBII) ratings, but instead of limiting values of 1.00 (for the former) and 50 per cent (for the latter) higher values would have to be selected.

It was obvious, however, that further adaptation of the CBI method was necessary. As delimited by it, the CBD includes blocks made up of establishments showing a wide variety of land uses, many of which are atypical of the CBD, and certainly so of the Hard Core. Since greater "purity" of CBD land uses may surely be considered an essential feature of the Hard Core the possibility of omitting certain blocks characterized by such uses—or at least of re-calculating the CBHIs and CBIIs accordingly—has to be considered. Among possibly atypical types of establishments three come immediately to mind:

(A) Certain government and municipal establishments which, while not strictly central business in function, are considered to be so under certain circumstances in the CBI method where their inclusion brings the CBHI and CBII ratings of the blocks concerned to the required minimum values.[5] This special rule might well be considered too lax in the case of the Hard Core only.

(B) Certain establishments which appear to require less than average centrality within the CBD and tend to be found for the most part near its edge, where they often benefit from more space and lower land values. Where such establishments do occur in the area of the Hard Core they might be considered atypical. Cinemas and hotels appear to be examples of this type.

(C) Certain lower quality, limited-range retail establishments. Quality, being difficult to measure, is not a criterion in the CBI method. It may nevertheless be necessary to take quality of retail establishments into account in Hard Core delimitation. In Cape Town, contrasts in the quality and range of goods are noticeable particularly in the case of department stores. Those

[4] Murphy and Vance, "Delimiting the CBD" *op. cit.*, pp. 201–219.

[5] *Idem*, p. 219. Strictly speaking, this also applies to other non-CBD or "X" land use categories as defined by Murphy and Vance. In practice, however, these are rarely found in the vicinity of the Hard Core.

near to the Peak Land Value Intersection (PLVI), well within the Hard Core, offer a wide range of generally high quality goods to customers apparently drawn from almost the entire urban agglomeration and beyond while others, located near the CBD edge, seem to function very largely as "suburban" stores, serving the lower-income residential sections of the Zone of Urban Blight, which is not fully served by shopping centers of its own, as well as customers from more distant suburbs. While these stores also take advantage of their CBD location in this latter respect the range and quality of their goods are generally inferior to those of the true department stores clustered around the PLVI. It is noticeable that the two groups are quite separate on the ground.[6]

On general principles it was concluded that delimitation should be based on the CBI method, but adopting higher limiting values for the CBHI and CBII, and devising special rules to take account of factors of the kind outlined above. The procedure described below was based upon these principles.

PROCEDURE FOR DELIMITATION

1. *Stages 1 and 2: Determination of CBHI and CBII Limiting Values and Initial Delimitation (Figs. 1 and 2A)*

The first problem was to determine appropriate limiting values for the CBHI and CBII. The fact that the Hard Core boundary, more so than that of the CBD itself, is in places visually evident by virtue of taller buildings or particular concentrations of land uses suggests that if CBHI and CBII values for all CBD blocks were to be plotted on graphs against numbers of blocks some "break of slope" might be revealed which would suggest the limiting values.[7] Such graphs were accordingly drawn and are shown in Figure 1. They suggest that the boundary should be drawn where the CBHI is 4.00 *and* the CBII around 80 per cent, and these values were used in the initial delimitation of the Hard Core as shown in Figure 2A (excluding isolated blocks but including those which, while falling short of the required values, are surrounded by included blocks, so that a continuous boundary line is obtained). It is noticeable in this figure that the CBII boundary encloses a far larger area than does the CBHI boundary; on the basis of local knowledge it is clear that the latter comes much closer to a true delimitation. This suggests that the *volume* of CBD uses in a building, rather than the *proportion* of it, is critical to Hard Core delimitation. Alternatively, it might suggest that the limiting CBII value of 80 per cent is too low—note that the exact position of the break of slope is not very clear in Figure 1A—although other values tried failed to give as good a boundary.

2. *Stage 3: Independent Cartographic Check (Fig. 2B)*

In his original CBD delimitation the present author drew two boundaries based upon other criteria, plotting these together with the CBI boundary

[6] There is room here for investigation of the real differences between the functions of the two groups. This would be mainly non-geographical in character and might include comparisons of credit facilities offered, the exact ranges and prices of goods offered, etc.

[7] A break of slope is also apparent at points on urban profiles drawn across the CBD. Compare Davies, *op. cit.*, Fig. 5, with Fig. 4 in this article.

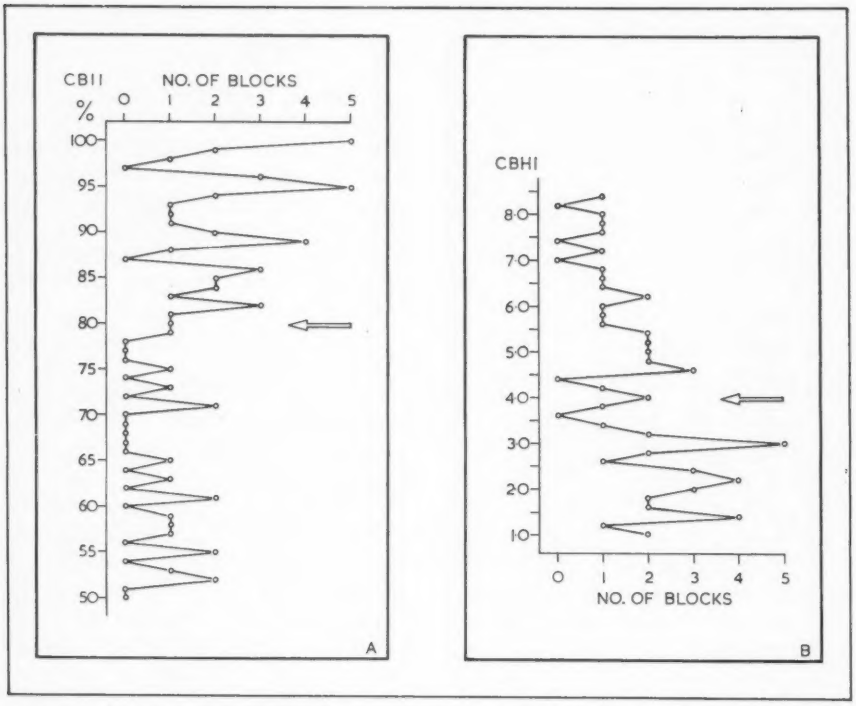

FIG. 1. Hard Core delimitation, Stage 1. Numbers of CBD blocks plotted against CBII and CBHI values. Arrows indicate suggested positions of breaks of slope.

on one base map as an independent check on the latter. A similar procedure was felt necessary here to insure that delimitation was along the right lines, and two boundaries based on the same criteria were drawn, as shown in Figure 2B. These were:

(A) A boundary based on a consideration of traffic within the CBD as recorded in a recent survey.[8] In the original CBD delimitation the numbers of principal visits made by car drivers to each city block on a given day, which had been recorded by means of a card survey and mapped, were studied as a sample of the total daily visits and a boundary drawn enclosing blocks where visits totalled 20 per cent or more of those to the peak block. As a check on Hard Core delimitation 30 per cent of the visits to the peak block was chosen as the limiting value, isolated blocks being omitted to give a continuous boundary line.

(B) A boundary based upon land valuation as determined by the 1945 Municipal Valuation (the latest available) and drawn on a lot basis. In the original CBD delimitation such a boundary was drawn enclosing lots (sub-

[8] *Idem*, p. 331, subheading "b." See S. S. Morris: "Parking in the Central Business District of Cape Town," Cape Town, City Engineer's Dept., 1957 (unpublished).

sequently changed to a block basis) where the valuation per square foot was 5 per cent or more of that of the peak lot valuation, excluding isolated lots to give a continuous boundary line. The same procedure was adopted in this case, but the boundary was drawn with the higher value of 30 per cent of that of the peak lot.[9]

As shown on Figure 2B these two boundaries delimit a Hard Core area which correlates reasonably closely with that defined by the modified CBI method (Fig. 2A), suggesting that

[9] Davies, *op. cit.*, p. 331, subheading "a."

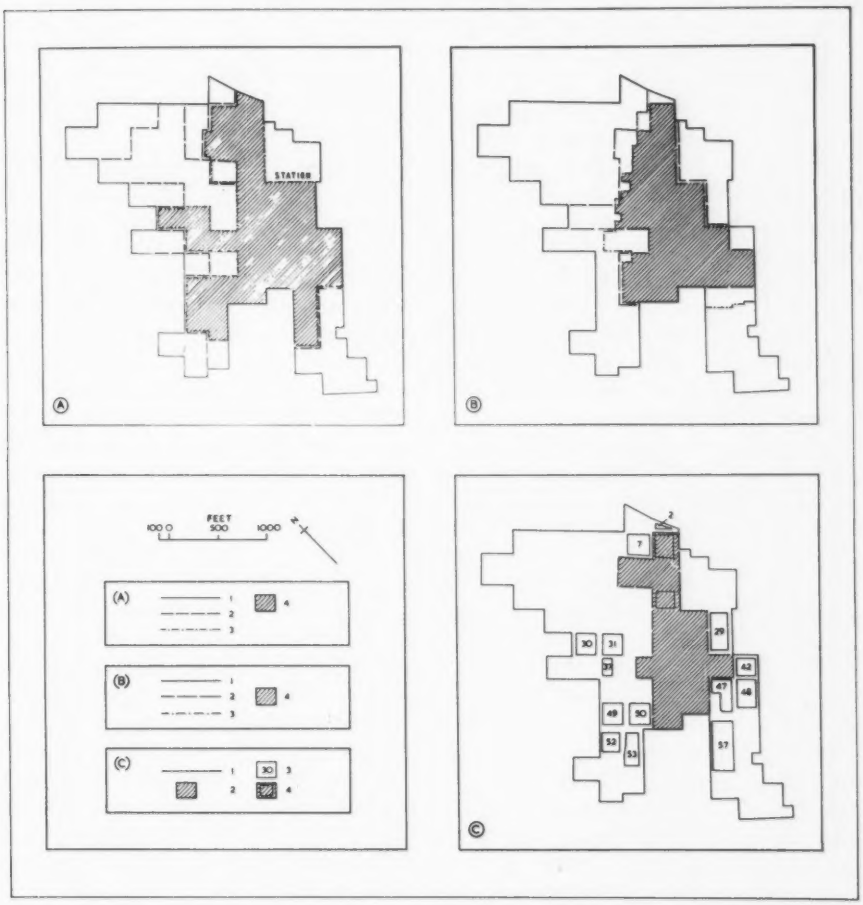

FIG. 2. Hard Core delimitation, Stages 2–4. Key refers as follows: (A)1, (B)1, and (C)1—CBD boundary; (A)2 CBII boundary of 80 per cent; (A)3. CBHI boundary of 4.00; (A)4. Hard Core as enclosed by *both* foregoing boundaries; (B)2. peak daily visits boundary of 30 per cent; (B)3. peak land value boundary of 30 per cent; (B)4. Hard Core as enclosed by *both* peak daily visit and peak land value boundaries; (C)2. Hard Core as defined by visual impression; (C)3. blocks lying between Hard Core boundaries as delimited in Figs. 2A and 2C (block numbers correspond with Fig. 4); (C)4. blocks within visual impression Hard Core whose CBII and CBHI values fall below required levels after application of exclusion rule (see text).

the general basis of delimitation is satisfactory.

3. *Stage 4: Independent Field Check (Fig. 2C)*

It was also decided to carry out a field check in order to test the CBI boundary further, this time on visual and common sense grounds, this being possible in view of the fairly clear visual impression which the Hard Core makes in the field. Such a check was also essential in order to determine the quality of certain retail establishments as discussed above. Accordingly, the CBI Hard Core boundary was followed carefully in the field and adjustments to it recorded directly on the base map in response only to visual impression and local knowledge. This modified boundary, which is, of course, entirely subjective in character, is shown in Figure 2C. Comparing this figure with Figure 2A it will be noted that while the general limits of the Hard Core within the CBD are again confirmed, and while particular sections of the two boundaries correlate well, elsewhere there are noticeable divergences. The Hard Core as delimited by visual impression is considerably more restricted in area than that enclosed by the CBI boundary, the effect of adjusting the boundary visually being to lop off certain branches of the Hard Core which result in such an irregular CBI boundary. This may be considered an improvement in that these irregularities appear to be essentially the result of the perhaps arbitrary nature of the limiting values chosen—there being often little difference between CBHI and CBII values on either side of the boundary—rather than the expression of anything significant. As is commonly the case with linear boundaries, the detailed shape of the CBI boundary would change greatly in response to very slight changes in limiting values; its over-indented outline on the northwest side is rather meaningless and even misleading, since it can readily lead to misinterpretations. Thus the regularity of the boundary in Figure 2A is in its favor, and expresses quite strong visual impressions in the field, particularly in some sections.

4. *Stage 5: Differences between the Field Impression and the Delimited (CBI) Boundary; and Final Delimitation (Figs. 3 and 4)*

In view of the discrepancies noted between these two boundaries it became necessary at this stage to decide whether or not to adjust the CBI boundary to the visual impression, either entirely or in part, noting that certain factors mentioned above suggested that the latter could not be ignored. (The alternative approach of choosing other CBHI and CBII limiting values had been tried but had failed to yield as good a boundary as those originally selected: the breaks of slope on the graphs [Fig. 1] had successfully pointed to the best values using the CBI method alone.) In practice this meant deciding whether or not to include within the Hard Core those blocks falling between the boundaries in Figures 2A and 2C—those numbered in the latter figure. Since both boundaries were based on land use, this decision could only be reached by carefully examining the land use of each of these blocks, searching generally for patterns or trends which could be interpreted.

On carrying out this examination, it was found that the blocks concerned tended to be dominated areally by one or more out of a list of half a dozen categories of land use. These are plotted for the entire CBD on Figure 3,

and the blocks may be roughly classified under three heads, as follows:

(A) Blocks dominated areally by uses which do not appear to require extreme centrality, namely cinemas, hotels, headquarters offices, and newspaper publishing and printing establishments. These may very briefly be examined in turn:

(*1*) *Cinemas.* As these are patronized by people coming from outside the CBD (the CBD has virtually no resident population, while matinee performances depend upon daily shoppers and others not tied to office hours) they are located more in relation to communications in and out of the CBD than to inter-communication

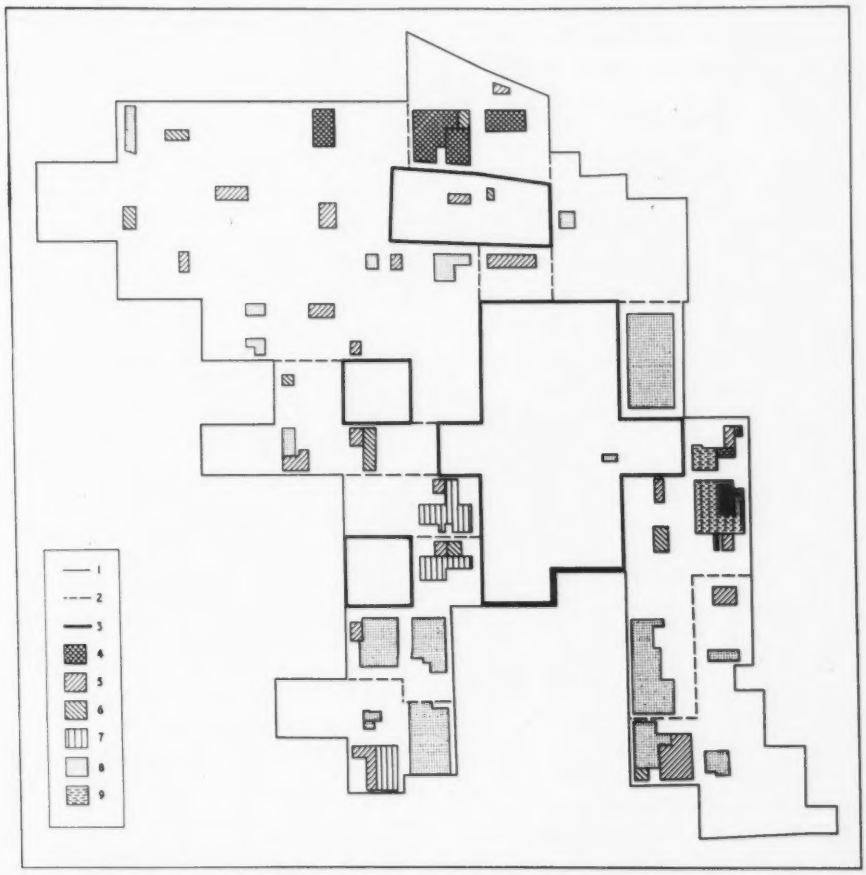

FIG. 3. Hard Core delimitation, Stage 5. Distribution within the CBD of certain land uses considered atypical of the Hard Core. Numbers refer as follows: 1. CBD boundary; 2. Hard Core boundary as defined in Fig. 2A (where different from 3); 3. Hard Core boundary, including outliers, remaining after applying exclusion rule; 4. cinemas; 5. hotels; 6. headquarters offices; 7. newspaper publishing and printing; 8. government and municipal offices; 9. "second-grade" department stores. Note that land uses are mapped for floors at which they occupy their largest areas; very small offices under "6" and "8" are omitted.

within it. Together with the fact that they require considerable space (they usually dominate areally the blocks in which they are located) this means that they tend to be found near the CBD edge and outside the Hard Core.[10] In Cape Town the central cinemas are clustered around the north-eastern or seaward end of St. George's Street (Blocks 5, 7, and 8 in Fig. 4—compare Fig. 3) where they are close to the suburban railway terminus (Block 16) and most of the bus routes, these advantages being reinforced subsequently by the most extensive

[10] They are nevertheless central business in character, offering recent films at prices above those in the suburbs to patrons from all parts of Cape Town. This group excludes the small "bio-cafés" with their older films, continuous shows, and lower prices—a few of which are found in CBD blocks. As these latter tend to be in basements (basement land uses could not be mapped) only two are shown in Figure 3 (Blocks 42 and 48).

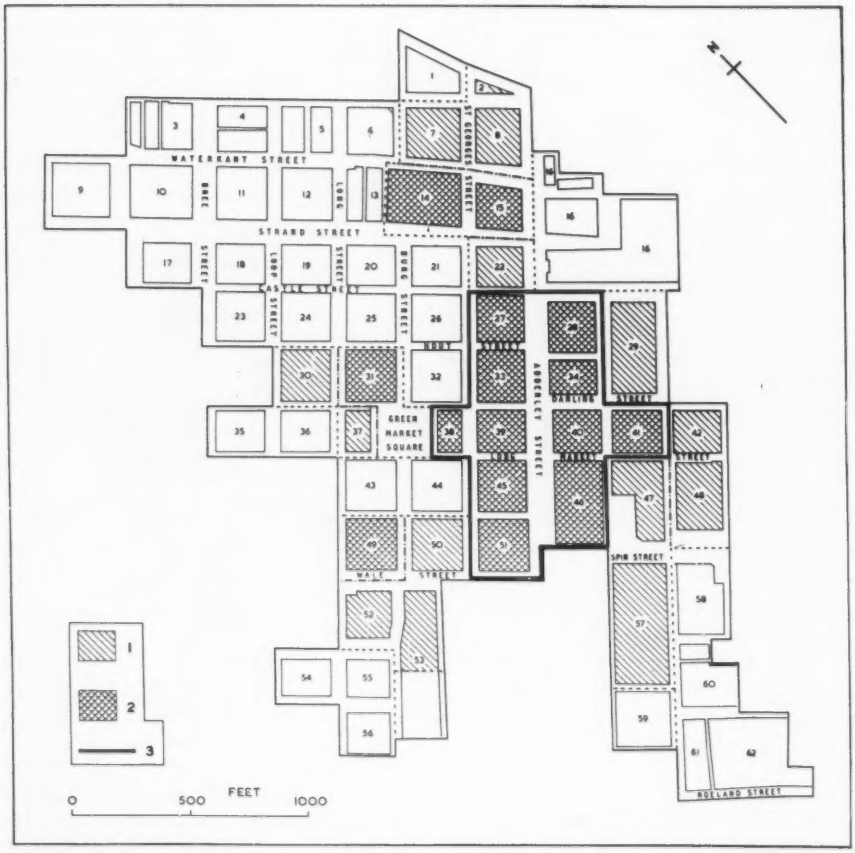

FIG. 4. The CBD and its Hard Core as finally delimited. All shaded blocks ("1" and "2") are those included in the Hard Core as defined in Fig. 2A. Numbers refer as follows: 1. Blocks omitted from Hard Core after application of exclusion rule; 2. Blocks retained under this rule; 3. Final Hard Core boundary (as in Fig. 3 but omitting isolated Blocks 14, 15, and 31).

parking facilities in the central area on the reclaimed but not fully built-up Foreshore.[11] These locational characteristics suggest that cinemas might well be considered non-CBD in character for the purpose of Hard Core delimitation.

(2) *Hotels.* Central hotels, while more numerous and scattered within the CBD than cinemas, also seem to have sought sites away from the Core, and for similar reasons—more space, lower rentals, and access to communications in and out of rather than within the CBD. Their distribution as shown on Figure 3 supports the findings of Murphy, Vance, and Epstein who, working in American cities, found "transient residences" to be scattered widely throughout the CBD except in their "Walking-Distance-Zone 1," an area extending a distance of up to 100 yards actual walking distance in all directions from the PLVI.[12] In Cape Town the distribution of hotels also continues outwards beyond the CBD boundary into the inner fringes of the Zone of Urban Blight (not shown on the figure). It would therefore appear justified to consider hotels as atypical of the Hard Core.

(3) *Headquarters offices.* A number of headquarters offices are located between the CBI and visual impression boundaries. Conducting much of their business within their own walls rather than dealing very much with the public at large, these again can be considered atypical of the Hard Core on the grounds of not requiring the extreme centrality which it offers. Two other factors tend to confirm this. Firstly, Murphy, Vance, and Epstein noted such offices tended to be located well out towards the CBD edge in their "Walking-Distance-Zone 3." Secondly, in Cape Town, headquarters offices are among the comparatively few major commercial establishments which have migrated to the suburbs in recent times—notably the head offices of three large insurance companies.

(4) *Newspaper publishing and printing establishments.* It is generally accepted that the main offices and presses of daily newspapers are properly found within the CBD. Again, however, they do not deal with large numbers of the general public, although they require both space and good access to communications in and out of the City. Perhaps only the newspaper advertisement offices deal regularly with large numbers of people on their premises. Of the three daily newspapers published in Cape Town, one (*Die Burger*) has its offices located right at the CBD edge (Block 56) and could under no circumstances be included within the Hard Core. The other two (*The Cape Times* and *The Cape Argus*—Blocks 50 and 44 respectively) both accept most

[11] See Davies, *op. cit.*, footnote 7.

[12] For this and other references to "Walking-Distance-Zones" see Raymond E. Murphy, J. E. Vance, Jr., and Bart J. Epstein: "Internal Structure of the CBD," *Econ. Geog.*, Vol. 31, 1955, pp. 21–46, ref. pp. 24–39.

advertisement orders by telephone and also through agencies scattered throughout Greater Cape Town. It again appears justified, therefore, to consider these establishments as atypical of the Hard Core.

(B) Government and Municipal Offices. It has been pointed out that government and municipal offices are strictly non-CBD in character, their inclusion in certain circumstances by the CBI method would seem to be a concession, and too much of a concession in the case of the Hard Core. In Cape Town such offices are mostly found just beyond the CBD boundary where they bar the way to CBD growth, but the special rules of the CBI method results in the location of some offices just within the boundary. There can be no objection to denying these offices a rightful place within the Hard Core.

(C) Blocks largely occupied by department stores offering goods of rather lower quality and noticeably more restricted range than those offered by department stores in the vicinity of the PLVI (the latter being the equivalent of the stores found by Murphy, Vance, and Epstein in their "Walking-Distance-Zone 1," within 100 yards walking distance from the PLVI). The nature and function of these "second-grade" department stores and their separation on the ground from the others have been discussed above and it has been concluded that they are atypical of the Hard Core. It is conceded that subjective judgment was used in this case: much work can profitably be done in the investigation and measurement of the differences in "quality" between these types of stores. Such work would, however, be mainly non-geographical in character and could not be attempted in this preliminary study. Only two blocks (Blocks 42 and 48) are affected in this case.

Thus most of the blocks falling between the CBI and visual impression boundaries of the Hard Core prove on investigation to be very largely made up of establishments which one can well consider to be atypical of the Hard Core on theoretical grounds. This tends to confirm the latter boundary at the expense of the former, and leads to the conclusion that the CBHIs and CBIIs of the blocks should be re-calculated counting the above-mentioned categories as "X" or non-CBD categories for the purpose (and *only* for the purpose) of Hard Core delimitation. This was accepted as a special rule for exclusion and the re-calculations carried out accordingly. Since the rule has to apply to *all* CBD blocks and not merely those lying between the CBI and visual impression boundaries re-calculation was carried out for all CBD blocks, while the distribution of the land use categories concerned was plotted for the entire CBD as shown in Figure 3 (the areas in each case being those of the floors where the land use reaches its *maximum* extent, not necessarily the ground floor areas. In the re-calculation, of course, *all* floors were taken into consideration).

Some impression of the effect of re-calculation may be obtained by studying Figure 3 in conjunction with Table I, which gives the re-calculations

TABLE I

RE-CALCULATIONS OF CBHI'S AND CBII'S OF EACH CBD BLOCK INITIALLY INCLUDED WITHIN (FIGURE 2A) BUT FINALLY EXCLUDED FROM (FIGURES 2C, 3, 4) THE HARD CORE. (FOR EXPLANATION, SEE TEXT.) BASED ENTIRELY UPON FIELD WORK

Block no.	*Atypical land uses present**	*Block areas of atypical uses*							*Ground floor areas*	*Block total areas*			*CBHI*		*CBII (%)*	
		C	*H*	*HQ*	*N*	*GM*	*D*	*Totals*		*CB use: previous definition*	*CB use: present definition*	*All use*	*Old*	*New*	*Old*	*New*
2	H	.....	20,696	.....	.....	.....	.....	20,696	4,576	22,880	2,184	22,880	5.000	0.477	100.000	9.545
7	C, HQ	134,784	2,496	.....	.....	.....	.....	137,280	41,184	195,728	58,448	195,728	4.752	1.419	100.000	29.862
8	C	65,312	.....	.....	.....	.....	.....	65,312	40,040	303,056	237,744	767,224	7.569	5.938	82.526	64.741
22	H	.....	87,464	.....	.....	.....	.....	87,464	30,784	195,104	107,640	195,104	6.638	3.497	100.000	55.171
29	GM	.....	.....	.....	.....	470,184	.....	470,184	65,104	470,184	0	470,184	7.222	0.000	100.000	0.000
30	HQ	.....	.....	11,232	.....	.....	.....	11,232	40,144	165,152	153,920	202,384	4.114	3.834	81.603	76.053
37	H, HQ	.....	6,032	74,880	.....	.....	.....	80,912	16,640	105,456	24,544	105,456	6.338	1.475	100.000	23.274
42	C, H, N, GM, D	†2,496	10,608	.....	832	624	25,896	40,456	30,680	156,104	115,648	164,424	5.088	3.769	94.940	70.335
47	H, HQ	.....	8,424	12,896	.....	.....	.....	21,320	48,880	203,216	181,896	205,608	4.157	3.721	98.837	88.467
48	H, N, D	11,232	10,920	.....	1,144	.....	64,064	87,360	49,920	230,880	143,520	260,312	4.625	2.875	88.694	55.134
50	H, HQ, N	.....	3,328	7,696	72,384	.....	.....	83,408	42,120	276,952	193,544	290,056	6.575	4.595	95.482	66.726
52	H, GM	.....	6,656	.....	.....	204,256	.....	210,912	33,904	221,312	10,400	221,312	6.528	0.307	100.000	4.699
53	GM	.....	.....	.....	.....	216,216	.....	216,216	44,720	268,216	52,000	334,672	5.998	1.163	80.143	15.538
57	GM	.....	.....	.....	.....	310,856	.....	310,856	104,208	478,920	168,064	490,672	4.596	1.613	97.605	34.252

All areas are given in square feet. (NB: as the base maps are compiled, not surveyed, slight errors are possible. The original calculations, which sought only *proportions* of areas, were made on the basis of a grid of 1/10th inch squares laid on the base map. These figures have been converted here to square feet taking the scale of the base maps as 1:1250 so that comparisons of actual areas may be facilitated. These absolute figures may have errors of one or two per cent.)

*Letters in this and following columns refer as follows: C—Cinema; H—Hotel; HQ—Headquarters Office; N—Newspaper Establishment; GM—Government and Municipal Office; D—"2nd-Grade" Department Store.

†Some of the total area of this small "bio-café" (see footnote 10), being below ground level, was not recorded.

for each block whose status as regards the Hard Core as initially delimited in Figure 2A was changed as a result of re-calculation (all other CBD blocks being unchanged). Blocks 2, 7, 8, 22, 29, 30, 37, 47, 50, 52, 53 and 57, previously included, were omitted as a result of their lying in the categories listed under "A" and "B," while Blocks 42 and 48 were omitted mainly as a result of the presence of "second-grade" department stores (under "C"). All but two (Blocks 31 and 49) of the blocks lying between the CBI boundary and the visual impression boundary were thus excluded. The exclusion rule fairly effectively converts the one boundary into the other. As *all* blocks in the CBD were re-calculated this was not, of course, achieved perfectly. Apart from Blocks 31 and 49, which remain as Hard Core outliers, Blocks 8 and 22 were now eliminated, although they had fallen within the Hard Core as delimited by visual impression (Fig. 2C). Thus a strict application of the rule results in a major Hard Core area centered on Adderley Street together with three small outliers caused by the outlier Blocks 31 and 49 and the fact that Blocks 14 and 15 are left as an outlier by the removal from the Hard Core of Block 22 (Figs. 3 and 4). In the initial CBD delimitation by the CBI method outliers were ignored for the good reason that the object of delimitation is the creation of a linear boundary around a single area. The requirements for Hard Core delimitation being identical in this respect, outliers must also, of necessity, be omitted here. The Hard Core as finally delimited is, therefore, that shown in Figure 4, which is the larger, central area in Figure 3.

SUMMARY AND CONCLUSIONS ON DELIMITATION

This article attempts only a step in the general direction of Hard Core delimitation as worked out for a single city and as a means to an end. The method of delimitation as applied in practice would be simple. Firstly, the CBHI and CBII of each CBD block should be calculated by the method set down by Murphy and Vance, except that cinemas, hotels, headquarters offices, newspaper publishing and printing establishments, government and municipal offices, and "second-grade" department stores are counted as "X" or non-CBD functions in these calculations. Secondly, the boundary is drawn to enclose CBD blocks with a CBHI of 4.00 or over *and* a CBII of 80 per cent or over, with all outliers omitted but with enclosed low-value blocks counted as being within the Hard Core.

While some of the land-use categories listed above came to mind on theoretical grounds, a clear picture emerged only when examining the "no man's land" between the initial CBI and visual impression boundaries. Figure 3 does suggest that these categories tend to be concentrated just beyond the finally-chosen boundary of the Hard Core: notice the contrast between the heavy concentrations of shading just outside the Hard Core boundaries (including outliers) and the general absence of shading within them. But while the Hard Core delimitation for Cape Town appears satisfactory, it is not claimed that the method will work equally well elsewhere. Only comparative studies can demonstrate whether the categories considered atypical in this case will prove to be so in other cities: for example, while the distribution of theaters did not affect the issue in Cape Town, it would appear likely that this is unusual and that normally they should be considered together with cinemas.[13] Again,

[13] One of the two cinemas in Block 7 is occasionally used for various theatrical purposes.

(*Continued on next page*)

while only department stores seem to be significant in Cape Town as regards the question of "quality," other retail establishments may show a similar dualism in other cities. Further, subjective judgment as used here in the case of department stores does not allow of detailed comparative study and cannot be considered acceptable as a means of determining rules of procedure in delimitation; if quality is to be a criterion, then it must be measurable. It is again emphasized, therefore, that this article is an initial step only. It is hoped that the approach rather than the precise procedure will prove useful in subsequent studies.

THE HARD CORE AS DEFINED: SOME OBSERVATIONS

It may be desirable to set down in conclusion a few random observations on certain characteristics of Cape Town's Hard Core as it was finally delimited, pending a fuller analysis of the internal structure. These characteristics emerge from an examination of Figures 4 and 5.

1. *The Location, Size, and Shape of the Hard Core (Fig. 4)*

The Hard Core is located asymmetrically within the CBD, being to the east and south of the geographic center. This location, together with that of the CBD itself within the built-up area of Cape Town, has been commented upon previously;[14] it is the result of artificial constriction of the CBD along its southeastern boundary together with the emergence on this side of major arteries leading to the main suburbs and the hinterland. The size of the Hard Core is quite small in relation to the entire CBD; it occupies some 16 per cent of the total area of the latter. Its shape, as now delimited, is compact, forming a blunt cross with its longer and broader arm clearly based upon the major northeast to southwest axis of Adderley Street, and bounded by the parallel St. George's and Parliament Streets. The smaller arm of the cross is made up of blocks lying between the two complementary one-way streets (Longmarket and Shortmarket Streets) which between them form the main cross-axis of the Hard Core.

2. *Land Values within the Hard Core (Fig. 5B)*

Figure 5B shows the Hard Core section of a simplified land valuation map of the central area based upon the municipal valuation for 1945, the isopleth values being in shillings per square foot. (A later valuation is still in progress at the time of writing.) This valuation is useful in that it reveals the situation within the CBD generally before developments on the recently-reclaimed Foreshore began to affect its character.[15] The most interesting feature of this figure is the position of the PLVI which, while naturally within the Hard Core as the focal point of the entire CBD, is not situated at its geographic center, but north of it along the main axis of Adderley Street.[16] Thus the center of high land values, as further indicated by the isopleths, is in the northeastern half of the Hard Core, from where values fall steadily southwestwards. There are several possible explanations for this fact. It may be related to the isolated (and omitted) section of the Hard Core to the northeast, for if

The only other theater within the CBD occupies a part of the tall office Block 46, but is not sufficiently large to affect its Hard Core status.

[14] Davies, *op. cit.*, p. 342.

[15] *Idem*, pp. 344–345.

[16] Note that the isopleths are based on lot values, while the PLVI is the peak intersection; therefore, the PLVI does not necessarily fall within the highest-value isopleth.

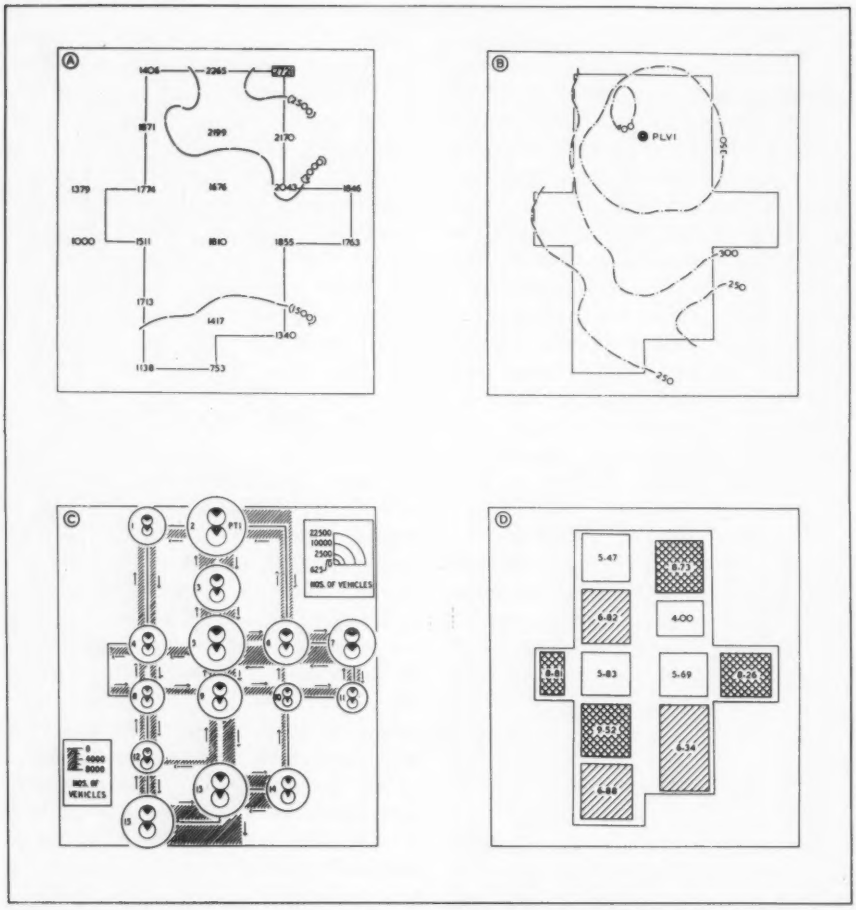

FIG. 5. The Hard Core. (A) daily visits, with peak daily visits intersection (2721); (B) land values, with PLVI; (C) movement of vehicular traffic, with peak traffic intersection (PTI); (D) total height indexes. (For explanation of figures, see text.)

this is included it becomes more central (Fig. 3). It could be an example of the supposed tendency of the PLVI to lag behind in the expansion of the CBD towards higher class residential areas (to the south) and away from the railway and industrial areas, which until quite recently lay along the sea front to the north.[17] If the latter is the true explanation the new valuation, when available, may well indicate an interesting change in PLVI direction of movement, for it may now be moving in the reverse direction towards the northeast, which should have changed from a CBD-repellant to a CBD-attractive area through the removal of the railway line to the docks and the post-war development of a CBD extension in the form of new office blocks and various amenities on the reclaimed Foreshore. As those new

[17] See Murphy, Vance, and Epstein: "Internal Structure of the CBD," *op. cit.*, p. 42.

buildings so far erected are still in the main grouped along the extension of Adderley Street onto the Foreshore (known as the Heerengracht), it seems unlikely that the PLVI will move away from the Adderley Street axis but rather along it towards the northeast. On the other hand pedestrian and vehicular traffic densities at least suggest that the strong pull of the suburban railway station may possibly be connected in some way with peak land values in its vicinity.

3. *The Movement of People and Vehicles within the Hard Core (Figs. 5A and 5C)*

Figure 5A gives some indication of the movement of people within the Hard Core during a normal working day. It is based upon the previously-mentioned parking survey,[18] which recorded at check points around the City the principal blocks to be visited on that day by each car driver questioned, as a sample of the total movement. The totals for each block were subsequently mapped. Figure 5A gives for each street intersection within the Hard Core the sum total of daily visits to the blocks immediately surrounding that intersection—usually four in number. As a very high percentage of white Capetonians—the main daily commuters to and from the Hard Core—both own and regularly use private cars, this may be considered a fair sample. But since it fails to give any indication of the destination of commuters arriving by train and bus, who presumably include most of the junior office staffs and many of the shoppers, it cannot give more than a general indication of the movement of people.

It will be noted that what might be termed the Peak Daily Visits Intersection lies in the extreme east corner of the Hard Core (the bordered figure No. 2721), due to the presence of the largest department store and office block, the central post office, and the suburban railway terminus (Blocks 28, 29, and 16 respectively in Fig. 4) at this intersection, these being the three most visited blocks according to the Survey. The isopleths reveal a steady fall in the numbers of visits away from this peak and towards the west and south. The figure, as far as it goes, thus tends to reinforce the impression, gained from studying Figure 4B, that the northeastern arm of the Hard Core is the main area of activity.

Another aspect of movement within the Hard Core is vehicular flow. From November, 1956, to February, 1957, the municipal authorities carried out a central city intersection volume count at major intersections, recording the numbers of vehicles passing through each intersection over a twelve-hour period and also during AM and PM peaks of one hour's duration (see Table II). These accurate and detailed counts were carried out on a basis of up to twelve possible directions of turn per intersection, and it was possible both to calculate and cross-check the numbers of vehicles passing *through* each intersection for the periods concerned.[19] This information is recorded in Figure 5C. The large circle at each intersection represents the twelve-hour total, the smaller ones those of the AM (upper) and PM (lower) peak hours respectively according to the scale given. The black segments of the smaller circles represent the proportion of commercial vehicles in the totals,

[18] Davies, *op. cit.*, p. 331, subheading "b."

[19] "Central City Intersection Volume Count, Cape Town," Traffic Survey Section, Town Planning Branch, City Engineer's Department, Nov., 1956—Feb., 1957. (Unpublished.)

TABLE II

AN EXAMPLE OF THE METHOD USED IN COMPILING FIGURE 5c. (BASED ON THE CENTRAL CITY INTERSECTION VOLUME COUNT, TRAFFIC SURVEY SECTION, TOWN PLANNING BRANCH, CITY ENGINEER'S DEPARTMENT, MUNICIPALITY OF CAPE TOWN, NOVEMBER, 1956 TO FEBRUARY, 1957)

Intersection number	*Number of routes leading in*	*Number of routes leading out*	*12 hour count*			*A.M. peak count*							*P.M. peak count*						
									Commercial vehicles only							*Commercial vehicles only*			
			Routes in	*Routes out*	*Mean*	*Routes in*	*Routes out*	*Mean*	*Routes in*	*Routes out*	*Mean*	*% of total*	*Routes in*	*Routes out*	*Mean*	*Routes in*	*Routes out*	*Mean*	*% of total*
2	3	4	5,793	5,311	.....	477	447	.....	95	85	...	....	650	605	.....	72	73	...	....
(PTI)	..	..	10,416	5,399	.....	1,228	551	.....	307	149	...	....	1,026	571	.....	277	148	...	....
.....	..	..	3,492	3,307	.....	283	265	.....	93	80	...	....	427	414	.....	55	41	...	....
.....	..	..	.....	5,684	.....	.....	725	.....	...	174	...	....	.....	513	.....	...	144	...	....
.....	..	..	(T) 19,701	(T) 19,701	19,701	(T) 1,988	(T) 1,988	1,988	(T) 495	(T) 488	... 492	.... 24.7	(T) 2,103	(T) 2,103	 2,103	(T) 404	(T) 406	... 405	.... 19.3

this information not having been recorded in the twelve-hour counts. The width of the diagonal shading is proportional to the numbers of vehicles moving along traffic lanes between intersections, according to the scale given. The importance of the Adderley Street major axis is well demonstrated by the large size of the circles and by the diagonal shading. Again it should be noticed that the northeastern end of the Hard Core is also the Peak Traffic Intersection (PTI—circle 2 on the figure), although east and west of Adderley Street the northeastern arm does not dominate the traffic flow map. Also interesting is the greater volume of traffic along the more northerly of the two one-way cross streets (Shortmarket Street) as compared with the other (Longmarket Street). Thus the street bringing traffic *in* from the main tributary areas to the east and south carries heavier traffic than its counterpart taking traffic out from the Hard Core, which clearly shares its load with other streets—particularly Strand Street. This, however, is principally of local interest.

Generally speaking there appears little significant difference between the sizes of the AM and PM peak circles in any intersection, nor does the proportion of commercial vehicles in the total vary much from one intersection to another. But the map does show the restriction to the flow of vehicular traffic across the Hard Core from southeast to northwest caused by the inadequate, narrow cross streets which are a relic of the original street plan,[20] and which have had to be declared one-way streets. The main value of the figure, however, is to demonstrate that the blunt cruciform shape of the Hard Core is indeed based upon certain axes of traffic movement. Intersections where no results are indicated may be assumed to have relatively small amounts of traffic movement.

4. *Total Height Indexes in the Hard Core* (*Fig. 5D*)

In this figure the Total Height Index (THI) of each block, i.e., the average height of each block expressed in floors, is stated to two decimal places.[21] Blocks with a THI of less than 6.00 are left unshaded, those from 6.00 to 8.00 diagonally shaded, while those above 8.00 are cross-hatched. The figure shows that while the buildings in the Hard Core generally form the tallest major group in the City, the tallest buildings of all are not in the Hard Core center but near its edge. This is a temporary condition which marks the present as a transitional stage in the rebuilding of the CBD, this transition also being expressed in the mixed nineteenth and twentieth century architectural styles present in the City's central areas.

ACKNOWLEDGMENTS

The author wishes to thank the South African National Council for Social Research for the financial assistance which made this study possible, the City Engineer of Cape Town and numerous officials in his Department for providing access to information, and Professor W. J. Talbot of the Geography Department, University of Cape Town, for constructive criticism and advice.

[20] Davies, *op. cit.*, pp. 342–343.

[21] See Murphy and Vance: "Delimiting the CBD," *op. cit.*, p. 208 *et. al.*

THE OKLAHOMA PANHANDLE—A CROSS SECTION OF THE SOUTHERN HIGH PLAINS

Arthur H. Doerr and John W. Morris

Dr. Doerr is an Associate Professor and Dr. Morris a Professor in the Department of Geography, The University of Oklahoma.

THE Oklahoma Panhandle, consisting of the three westernmost Oklahoma counties—Cimarron, Texas, and Beaver (Fig. 1)—is a land of contrasts. Within this area means are insignificant, averages misleading, and generalizations are often invalid. Flat plains alternate with dissected semi-badlands; bitter cold and snow vie with blistering heat and dust; fertile calcareous soils contrast with sterile blow sand; bounteous grain yields alternate with crop failures; huge ranches compete with small subsistence farms; emigration meets immigration.

Such an area resists adequate description, but some generalizations have merit. Rural property size is steadily increasing; irrigation is expanding apace; mechanization on farms is an accomplished fact; conservation techniques and scientific agriculture are making substantial gains; and the residents of the region have among the highest per capita incomes in Oklahoma.

The Oklahoma Panhandle, projecting westward as it does from the 100th meridian to the 103rd meridian, provides a sampling avenue that gives valuable insight into the southern High Plains. Indeed, the limits of this transverse segment are almost coincident with the eastern and western boundaries of the High Plains. Although many investigators have suggested boundary lines between the High and Low Plains portions of the Great Plains, agreement among them is rarely attained. The authors suggest that the High Plains boundary is very near the eastern boundary of Beaver County.[1] Heavy stream dissection and proximity to the margin of the Tertiary in this region present presumptive evidence in the absence of any other significant line of demarcation. And, while it is true that projections of the Great Plains extend west of the western boundary of Cimarron County, volcanic disturbances associated with Mt. Capulin in New Mexico give a somewhat different character to northeastern New Mexico. Fortunately, then, the Panhandle counties, political entities, provide a valid transverse sample of the southern High Plains. Such a circumstance assists in the gathering of data, and provides a measure of statistical validity which is often difficult to attain in regions other than political units.

The nature of the area allows a dual objective to be met. One purpose of this study is to provide a geographic inventory of the Oklahoma Panhandle which presumably might have multiple uses. Inventories are necessary for intelligent planning, and planning is essential to prevent economic disaster in the southern High Plains during periods of

[1] Many arguments have been advanced and many lines have been drawn in an attempt to demarcate the High Plains boundary, but a recent map by N. M. Curtis, Jr., and W. E. Ham, *Physiographic Map of Oklahoma*, Oklahoma Geological Survey, 1957, lends credence to the authors' belief that the boundary of the High Plains is at, or very near, the eastern boundary of Beaver County.

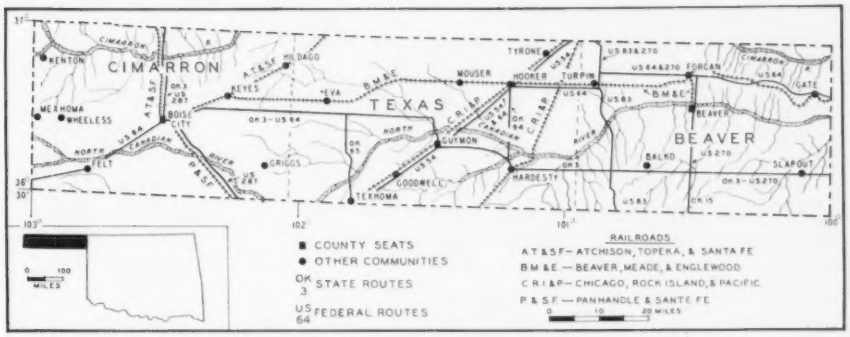

FIG. 1. Location map of Oklahoma Panhandle.

recurring drought. In addition, such a study provides information of value to geographers and others which has greater validity than more generalized studies of various types.

A second objective is to provide a sample, which might be extrapolated, in part, into other areas with similar geographic frameworks and problems. Analogous areas undoubtedly experience similar difficulties, and suggested solutions for Panhandle dilemmas, while not panaceas, might have a palliative effect in other regions.

HISTORICAL BACKGROUND

The history of the Panhandle is a varied one.[2] Long before the discovery of America, Plains Indians used the caves of northwestern Cimarron County for homes. In some of these, artifacts of a basket weaver stage of civilization have been found. The remains of an ancient irrigation ditch in eastern Beaver County is believed to have been used to bring water from the Cimarron River in Kansas. And, for centuries, the Indians had followed the buffaloes across the High Plains, using their kill for both food and shelter.

The first white leader to cross this territory was Coronado when, in 1541, 56 years before the founding of Jamestown, he led his men toward the fabled cities of Quivira. In his northward journey he may have crossed Beaver County near the present towns of Beaver and Forgan; on his return to Santa Fe his troops probably crossed parts of Texas and Cimarron Counties. The first country to claim the Panhandle lands was Spain. Soon thereafter the French also claimed the area on the basis of LaSalle's proclamation stating that all land drained by the Mississippi River belonged to that country. For a brief period, 1803–1819, the region was believed to belong to the United States as a result of the Louisiana Purchase. However, the Adams-Onis Treaty, which fixed the southwestern boundary of the Louisiana Purchase, left the area under Spanish rule. Shortly thereafter, in 1821, Mexico seceded from Spain, and the Panhandle became a part of that new nation. When, in 1836, Texas proclaimed its independ-

[2] Details of Panhandle history are available from a number of sources, among them George Rainey: *No Man's Land*, Enid, Oklahoma, 1937; Roy Gittinger: *The Formation of the State of Oklahoma*, The University of Oklahoma Press, Norman, Oklahoma, 1939, pp. 171–175; Joseph B. Thoburn and Isaac M. Holcomb: *A History of Oklahoma*, Doub and Co., San Francisco, California, 1908, pp. 168–170; Muriel H. Wright: *The Story of Oklahoma*, Webb Publishing Co., Oklahoma City, Oklahoma, 1929, pp. 253–255; and Edwin C. McReynolds: *Oklahoma, A History of the Sooner State*, University of Oklahoma Press, Norman, Oklahoma, 1954, pp. 8, 10, 71, and 260.

ence, and included all land between the Rio Grande and the United States within its boundaries, the nationality of the Panhandle again shifted. Not until 1845, when Texas joined the United States, did the area become a part of this nation. During all this period the Plains Indians continued to use the Panhandle as a part of their hunting grounds. No white settlements were established, and the chief indicator of white civilization was the Santa Fe Trail that crossed northwestern Cimarron County.

Since Texas asked for admission to the Union as a slave state, it was required, under the terms of the Missouri Compromise of 1820, that she give up all land north of 36° 30′ N. In 1850 when the boundaries of the present state of Texas were fixed by the Congress of the United States, the southern boundary of the Panhandle was determined. Soon thereafter New Mexico Territory was organized with the 103rd meridian as its eastern boundary, thus establishing the western edge of the Panhandle. When Kansas Territory was established with the 37th parallel as its southern boundary, the formation of the Panhandle was complete. This strip of land, extending eastward from New Mexico to the Cherokee Outlet, a distance of 166 miles or three degrees of longitude, and southward from Kansas Territory (later Kansas and Colorado Territories) to Texas, a distance of 34 miles or one-half degree of latitude, formed the area which became known as "No Man's Land."

"No Man's Land," the name long applied to the Oklahoma Panhandle, was an apt name, for the land for a number of years belonged to no individual or group of individuals and was not subject to the laws, rules, or regulations of any state or territory. From 1850 until 1889, when the Panhandle was added to the newly formed Oklahoma Territory for governmental purposes although the two had no common boundary, it was the haven for the notorious outlaws of the Southwest. Quickness of the draw with "Judge Colt" was frequently the deciding factor of life or death. During this same period the "rugged individualists" of the frontier, the cowboy and the squatter, succeeded in settling parts of the better ranch lands and the more favorable farm lands. Frequently these people would band together to bring law and order to the territory. At one time they organized a territorial government, elected officials, selected Beaver as the capital, and applied for admission to the Union as the state of Cimarron.

With its addition to Oklahoma Territory the Panhandle became known as Beaver County, and the town of Beaver served as the county seat. When Indian Territory and Oklahoma Territory were united to form the state of Oklahoma in 1907, the Panhandle became part of that state. It was then divided into the three counties of Beaver, Texas, and Cimarron.

LANDFORMS

That portion of the High Plains which includes the Oklahoma Panhandle, like the High Plains as a whole, is composed of detrital material deposited by streams which headed in the Rocky Mountains to the west. Tertiary streams deposited material which was predominantly silt but which contained quantities of sand and gravel as well. These deposits masked an irregular erosion surface, and the resultant upland surface is, for the most part, flat and regular. Subsequent erosion has produced local irregularities,

and locally cemented beds stand out as ledges or escarpments.[3]

Local erosion of the Cimarron and tributaries has exposed some Cretaceous, Triassic, and Jurassic sediments in northwestern Cimarron County, producing a somewhat rougher terrain than is generally encountered in the Panhandle. The underlying Permian rocks are exposed along the North Canadian River in Texas and Beaver Counties. Quaternary and recent deposits are to be found locally along stream valleys.

The present landscape is notably flat in most areas, with the roughest terrain encountered in the previously mentioned dissected area of Cimarron County and in eastern Beaver County. Most of the region except eastern Beaver County and northwestern Cimarron County has a local relief of less than 50 feet. Elevations increase from about 2100 feet near the eastern margin of Beaver County to almost 5000 feet at the crest of Black Mesa, which stands 300–500 feet above its base in western Cimarron County.

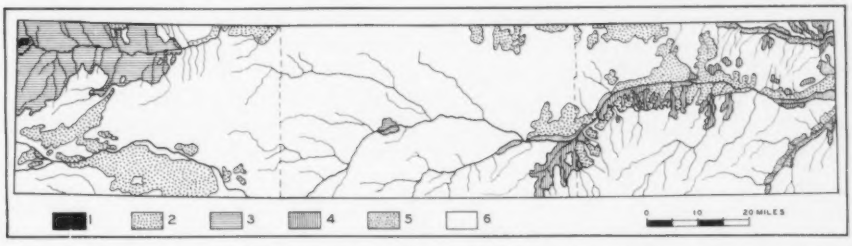

FIG. 2. Geologic map of Oklahoma Panhandle, modified from Hugh D. Miser, Geologic Map of Oklahoma, United States Geological Survey, 1954. Numbers refer as follows: (1) Tertiary basalt; (2) Quaternary high terrace deposits, dune sand, loess, and volcanic ash; (3) Triassic, Jurassic, and Cretaceous sedimentaries; (4) Permian sedimentaries; (5) Recent alluvium; (6) Tertiary dune sands and sedimentaries.

A further complexity is introduced by a lava flow encroaching upon northwest Cimarron County associated with vulcanism in the Capulin area of New Mexico. Basic geologic patterns are shown in Figure 2.[4]

The impression of flatness, while not wholly valid, is sufficiently accurate to leave with the reader. Rarely does terrain restrict, to any great degree, human use of the land.

CLIMATE

Climatological records are so few and data so incomplete, both in terms of length of record and in geographical distribution of stations, that generalizations about the climate of the Oklahoma Panhandle must be highly suspect. For example, Kenton in the western part of the Oklahoma Panhandle was reported to have an annual precipitation of 15.5 inches by Bollinger, 16.73 inches by the United States Weather Bureau more recently, and 17.11 inches by a

[3] Nevin M. Fenneman: *Physiography of Western United States*, New York, 1931, pp. 11–12, and 45; Willard D. Johnson: *The High Plains and Their Utilization*, United States Geological Survey, Twenty-first Annual Report, Part IV (Washington: Government Printing Office, 1900), pp. 612–613.

[4] Early detailed geologic work in the Oklahoma Panhandle is reported in three bulletins of the Oklahoma Geological Survey: E. P. Rothrock: *Geology of Cimarron County, Oklahoma, Bulletin No. 34*, Norman, Oklahoma, October, 1925; Charles N. Gould and John T. Lonsdale: *Geology of Texas County, Oklahoma, Bulletin No. 37*, Norman, Oklahoma, April, 1926; and Charles N. Gould and John T. Lonsdale: *Geology of Beaver County, Oklahoma, Bulletin No. 38*, Norman, Oklahoma, August, 1926. A more recent contribution to the geology of the region is the excellent map of the Geology of Oklahoma cited in the caption of Figure 2.

water resources committee in Oklahoma City in 1954.[5]

Similarly there is some evidence to suggest that climatologists in the past have been too generous with the amounts of moisture they assign to the Panhandle in isoplethic maps. To illustrate, *Climate and Man*, the Yearbook of Agriculture for 1941, shows the 22-inch isohyet essentially coincident with the eastern boundary of Beaver County. On the other hand, a similar map, drawn on the basis of a longer record for *Oklahoma Long Range Water Program* previously cited, shows the 20-inch isohyet in almost the same position as the 22-inch isohyet in *Climate and Man*. In fact the data in *Oklahoma Long Range Water Program* suggests that no station within the Oklahoma Panhandle receives an average annual total of as much as 20 inches. Precipitation means are meaningless in the area. During wetter periods crops flourish and range land is productive. During dry periods the soil blows, dust fills the air, the landscape and the atmosphere are grey-brown, and economic life of the region shrivels. Radical oscillation from "normal" precipitation is the commonplace rather than the unexpected, and deviations below the average are far more numerous and prolonged than variations above "normal" precipitation.

Some reasonably homogeneous precipitation patterns are observable, however. Maximum precipitation occurs during the growing season, and snowfall is usually light.[6] Exceptions do occur, and blizzards may come driving out of the north on howling winds, doing great damage. Such a blizzard occurred in March of 1957, doing severe damage to grain crops and cattle (Figs. 3 and 4).

Droughts tend to occur within the Panhandle at much the same time that they are being experienced elsewhere in the Great Plains.[7] Some evidence suggests a short-term cyclical period of roughly 11 years between peaks and troughs of the precipitation curve.

Plagued by small amounts of precipitation and locally very porous soils, the Panhandle is made even more droughty by high evaporation rates. Open-pan evaporation rates are variously suggested as being in excess of 60 inches per year.[8] Heavy evaporation is induced by high summer temperatures and strong winds.[9]

Winds are an omnipresent part of the plains and mean velocities are higher here than in any other part of the United States except near Cape Hatteras and in the Straits of Juan de Fuca. The region has the dubious distinction, along with an adjacent section of the Texas Panhandle, of having the highest mean velocities in the interior of the United States. Mean velocities are for the most part in excess of 12 miles per hour and may be as high as 18 miles

[5] C. J. Bollinger: *The Geography of Oklahoma*, New York, 1930, p. 11; United States Weather Bureau: *Climatic Summary of the United States*, U. S. Government Printing Office, no date, p. 20; Water Resources Committee: *Oklahoma Long Range Water Program*, Oklahoma City, Oklahoma, 1954, p. 8. These variations actually reflect an increasing length of record, and undoubtedly a record extending to the present would yield an average substantially different from the ones cited.

[6] John R. Borchert: "The Climate of the Central North American Grassland," *Annals of the Assn. Amer. Geogrs.*, Vol. 40, 1950, pp. 1–40.

[7] *Ibid.*

[8] Joseph B. Kincer: "The Climate of the Great Plains as a Factor in Their Utilization," *Annals of the Assn. Amer. Geogrs.*, Vol. 13, p. 73, suggests a figure of 60" for open-pan evaporation in the southern Great Plains. C. J. Bollinger, *op. cit.*, on pp. 9–10 states that evaporation from open-pan surfaces is 65–72". Specifically in 1956, according to Mr. Delbert Schwab, County Irrigation Specialist at Guymon, Oklahoma, evaporation from an open pan near Goodwell was 72".

[9] Some limited experimentation with hexadeconol (evaporation inhibitor) is planned within the Panhandle according to county agents and soil conservation people, but high winds probably preclude its widespread use. Choppy tank surfaces, induced by heavy winds, tend to negate the value of hexadeconol.

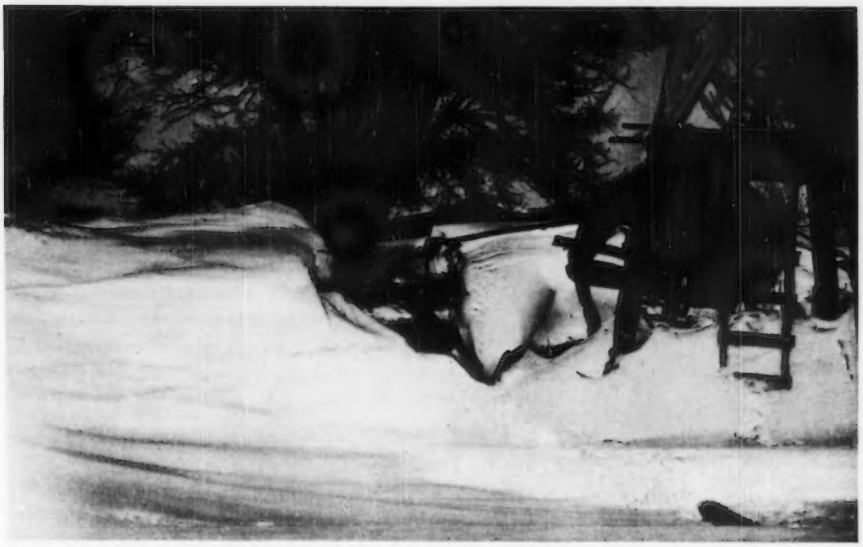

FIG. 3. Aftermath of the severe blizzard of March, 1957, in the Oklahoma Panhandle. High winds caused severe drifting in some areas as shown in this picture, while other areas were swept completely bare of snow. Power lines were down, roads were blocked, trains were stalled, and the only communication with the area for three days was by radio and via bulldozer and snowplow crews. Such howling blizzards sweeping down on the wings of a "norther," while not commonplace, do occur and wreak havoc on life and property.

per hour.[10] A dead calm is almost unknown, and the moan of the wind is familiar to all residents and travelers.

Winds descend with a biting cold in the winter as though they had originated at the Pole, and in the summer searing blasts from the southwest seem to come from the bowels of hell. Prevailing winds are somewhere from a westerly quadrant, and those from the southwest predominate.

Winter minima and summer maxima are accentuated by the wind. Relatively mild winters are the rule and hot summers are typical. Variations of temperature from station to station within the Panhandle are minor and of little consequence. Kenton in the western Panhandle has an annual mean of 54.8° F., a mean minimum of 34.7° F., and a mean maximum of 76.3° F. Erratic variations are again the rule, and Guest reports that this same station experienced a mean minimum for the year of 39.2° F., a cold month's mean minimum of 18.4° F., and a warm month's mean minimum of 61.7° F. Similarly, this same station reported an annual mean maximum of 70.5° F., a cold month mean maximum of 50.7° F., and a warm month mean maximum of 91.1° F.[11]

Below freezing temperatures are common in the winter, and sub-zero days are not rare. Ninety-degree days are expected in the summer, and 100 degree days are quite commonplace. Growing season varies from about 170 days in the

[10] Walter Prescott Webb: *The Great Plains*, New York, 1931, p. 23, and *The Future of the Great Plains*, Report of the Great Plains Committee, United States Government Printing Office, Washington, D. C., 1936, p. 29.

[11] Buddy Ross Guest: *Resource Use and Associated Problems of the Upper Cimarron Area*, Research Paper No. 19, The University of Chicago, Chicago, Illinois, June, 1951, p. 12.

FIG. 4. Death and destruction caused by the blizzard of March, 1957, in the Oklahoma Panhandle. Animal losses were severe as illustrated in this picture. Note the dead animal in the foreground, and the number of dead animals back of the farmer in the middle background. In the field in the foreground wheat has been blown out.

west to approximately 190 days in the east. Late spring frosts are common, and early frosts in the fall often damage crops.

So far as can be determined with spotty records, therefore, the climate is less than salubrious. Paucity of moisture, unreliability of precipitation from year to year and season to season, sizzling heat, bitter cold, occasional blizzards, violent thunderstorms, infrequent tornadoes, and other irregularities combine to try the spirit of the residents. Climatically, the Oklahoma Panhandle is a land of whim and caprice.

The region is on the boundary line between humid and semiarid according to the Köppen classification and mostly semiarid by the Thornthwaite classification.[12] Because of the tremendous variations in salient climatic characteristics from year to year, climatic classifications in current use are of little value in characterizing the region.

NATURAL VEGETATION

The Oklahoma Panhandle is short-grass country. Deviations from this general pattern are few and localized. Short bunch grass, such as grama grass (*Bouteloua gracilis*) and buffalo grass (*Bulbilis dactyloides*), dominates the region. Except where man has interfered, the vegetation cover of the Oklahoma Panhandle is essentially continuous. It is true that grass height diminishes somewhat from east to west and that the ground cover is not quite so complete as one moves westward, but for all intents and purposes the natural vegetation may be thought of as a grass mantle. Scrub oak (*Quercus gambelli*), cedars (*Junipera*), and piñon (*Pinus edulis*) may be found in occasional breaks, particularly in northwestern Cimarron County. Sage (*Artemisia tridenta*) and yucca (*Yucca elata*) appear in more xeric regions and where overgrazing has damaged the original sod cover.[13] Webb has made the interesting suggestion that the practically continuous sod cover of the High Plains has protected the upland surface from the ravages of erosion.[14]

SOILS

The soils of the region are pedocalic, falling generally under the chestnut brown or brown steppe great soil groups.[15] Topsoils generally react neu-

[12] The Trewartha system classifies the majority of the region as semiarid, and the authors concur with Thornthwaite and Trewartha that the area possesses all the salient characteristics of semiaridity.

[13] The classic brief vegetative treatment of the Great Plains is to be found in H. L. Shantz: "The Natural Vegetation of the Great Plains," *Annals of the Assn. Amer. Geogrs.*, Vol. 13, pp. 81–108.

[14] Walter Prescott Webb, *op. cit.*, pp. 15–16.

[15] A generalized treatment of Great Plains soils is available in C. F. Marbut: "Soils of the Great Plains," *Annals Assn. of Amer. Geogrs.*, Vol. 13, 1923, pp. 41–80.

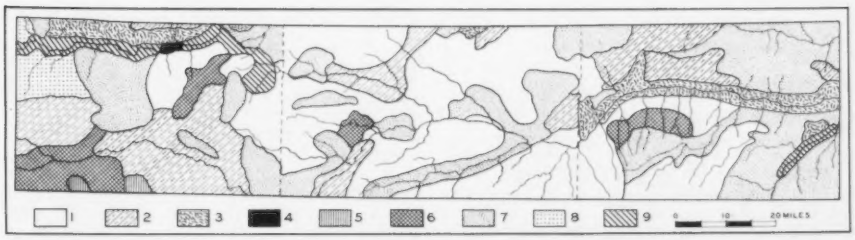

FIG. 5. Soils map of the Oklahoma Panhandle modified slightly from one appearing in the report of the Great Plains Committee cited in the text. Most of the better and more productive soils are on the upland surface away from the streams. Numbers refer as follows:

1. Granular loams, silt loams, clay loams, and silty clay loams with heavy cloddy subsoils. Deep surface very susceptible to wind erosion, subsoils resistant. Used mainly for small grains.
2. Structureless loamy sands and lighter sandy loams with somewhat heavier and more compact subsoils. Very susceptible to wind erosion. Used for range and row crops.
3. Old sand dunes with vegetative cover. Structureless, with loose open subsoils. Very susceptible to wind erosion. Used for range.
4. Unvegetated sand usually in a shifting state. A very serious wind erosion menace.
5. Granular to cloddy loams, silt loams, clay loams, and silty clay loams with cloddy heavier upper subsoils usually calcareous at shallow depths. Moderately susceptible to wind and water erosion. Used mainly for small grains.
6. Granular to cloddy shallow loams, silt loams, clay loams, and silty clay loams, usually calcareous at surface or at shallow depths. Readily damaged by wind and water erosion because of shallow depths. Used for range, small grains, and row crops.
7. Heavy phase sandy loams with somewhat heavier and more compact subsoils. Very susceptible to wind erosion. Used for row crops.
8. Rough broken land frequently stony. Very susceptible to water erosion and locally subject to wind erosion. Used for range.
9. Bottom lands, mostly sandy. Subject to wind erosion in exposed locations. Used mostly for range or agriculturally barren.

tral chemically. Topsoil depths range from about 12 inches to 28 inches or more. In the western part of the Panhandle lime concretions are found 12 to 18 inches beneath the surface, while to the east they are somewhat more deeply buried.[16] Inherent fertility is high with potash abundant, phosphorous generally good, and nitrogen typically weak. Plant response, except to nitrogen, is negligible except where additions of phosphorous induce higher yields on sandy, porous soils.[17]

Most upland soils are loamy in texture, and sands are quite abundant near streams. Broken, stony land is mainly coincident with the rougher terrain of western Cimarron County (Fig. 5). The margins of stream valleys mark occasional exposure of rougher stony terrain, usually outcrops of caliche, or consolidated Tertiary sediments.

Panhandle soils share a universal proclivity for erosion. Plowing or denudation of range land through overgrazing leads to serious wind erosion problems during many years. With rare exceptions in the most despoiled regions the soils are high in inherent fertility. Of the basic resources soil is probably the most valuable.

LAND USE

Agriculture, including grazing, has been, is, and will continue to be the most significant activity within the Great Plains. Great hardships for the people and serious damage to the land

[16] Interview with Mr. Eugene Williams, County Agent of Cimarron County, Boise City, Oklahoma.

[17] County Agents Eugene Williams, Cimarron County; Delbert Schwab, irrigation specialist for the entire Panhandle; and Bill Strom, Beaver County were unanimous in their agreement on this point during personal interviews in mid-April of 1958.

has been occasioned by attitudes and actions of the people of the region.

> From the beginning, the homesteaders of the Plains experienced great suffering, many finding it necessary to return home to the humid land. They blamed their misfortunes on the climate (drought, hail, blizzards, dust) and its attendant rigors (leaf rust and grasshoppers). Inexperienced in the conditions that made for the uniqueness of a semiarid land, they did not look for the explanation of their hardship in inappropriateness of their forestland way of living. They failed to see the need for fitting their institutions and their philosophy to the facts of semiaridity in the Plains. And there was no help to be found in any of the customary, traditional patterns of contending with environment. Western civilization, nurtured by humid-area and forest-land influences, did not possess knowledge of this kind of living.[18]

For the first half century of white settlement in the region, the settlers attacked the environment rather than attempting to cooperate with nature. Profligate use of natural resources combined with the dry decades of the 1930's led to the establishment of the "dust bowl" and the sad trek westward of the "Okies." But in every misfortune lies a lesson, and the populace of the Oklahoma Panhandle learned their lesson well enough to enable them to weather the dry years of the 1950's with a minimum of dust and hardship.

Whatever the crop, or indeed the type of grass, the principal problem of Panhandle farmers is the acquisition and retention of adequate moisture. Before the days of large-scale irrigation within the region the farmers utilized a variety of moisture-conserving techniques. Many of these techniques have been elaborated upon and new methods evolved to preserve moisture by the dry-land farmer.

Drought-resistant crops and varieties are utilized. Agricultural plots are fallowed. Trash and stubble cover are left on the field. Plowing without turning the soil is a common practice. Basin listing is employed both as a water conservation measure and a wind erosion deterrent.

Farmers of the Panhandle have learned to make optimum use of water through mulching, fallowing, and rotation. In addition they have supplemented natural precipitation with irrigation. Trench silos for grain and feed storage carry cattle through droughts. Larger land units and intimate cooperation with county agents and conservation people provide a more stable agricultural community.

There are almost 2,000,000 acres of crop land and 1,750,000 acres of range land within the three Panhandle counties. Wheat and grain sorghum are by all odds the most significant crops within the region. Acreage varies depending upon government allotments and the vagaries of the weather. Typically there are about 750,000 acres each of wheat and grain sorghum within the region.[19] The remaining portion of the crop land is devoted to less significant uses such as broom corn, alfalfa, corn, and fallow. Huge combines harvest the grain, and the ubiquitous elevator is an omnipresent part of the landscape (Figs. 6 and 7).

Range land occupies almost 1,750,000

[18] Carl Frederick Kraenzel: *The Great Plains in Transition*, University of Oklahoma Press, Norman, Oklahoma, 1955, p. 6.

[19] Acreage figures are composites of those described by each of the three county agents. It must be borne in mind that acreage figures oscillate greatly from year to year depending upon government acreage allotments and the amount and seasonality of precipitation.

FIG. 6. Combine harvesting wheat on the rich, level upland surface of the High Plains in the Oklahoma Panhandle. Photograph taken near Guymon.

acres, which amounts to nearly all of the remaining area. Expansion of crop land into range land is impractical, since rough terrain or sandy soil precludes adequate crop returns on lands now devoted to range.

Panhandle farms are large, varying from about 2350 acres in Cimarron County to 1100 acres in Texas County and 900 acres in Beaver County. This westward increase in farm size is directly attributable to increasing aridity.[20] Indeed the trend of the past two or three decades has been an expansion in farm size. Dry-land farms are devoted almost entirely to grain sorghum or wheat.[21] These crops occupy approximately coequal status in the dry-land farming scheme of things (Fig. 8). It would be a mistake to assume, however, that in any given year the acreages would be about equal. Several factors combine radically to change the ratio of wheat to grain sorghum in a given year. Natural phenomena such as drought, hail, and wind alter the ratio depending upon the season in which they occur. For example, if rains in the fall and winter fail, the fields planted to wheat may be plowed up and planted to sorghums. Hail or drought-induced failures of sorghum crops may force the planting of additional wheat. Governmental acreage quotas play a major part in determining the acreage of a given crop in a given year.

Average yield figures for dry-land crops are almost meaningless unless they are placed within the framework of a given year. Over a period of time wheat shows a rough average yield of 10 to 12 bushels per acre. In a dry year, however, over-all yields may average two to three bushels per acre and complete crop failures may be prevalent. On the other hand, in wet years average

FIG. 7. Grain elevator at Guymon. Elevators are ubiquitous; they rise like skyscrapers in the distance as one travels across this portion of the Great Plains.

[20] These figures vary slightly from those appearing in the *Census of Agriculture for 1954*, but they represent valid figures for 1958 on the basis of county assessors' compilations as determined by personal interview in April, 1958.

[21] This statement was made by each of the county agents within the Panhandle counties and corroborated by the authors in more than 250 miles of strip mapping in every part of the area. These field strip maps are on file and may be consulted by any interested reader. Only one strip is reproduced herein, because valid generalizations about the cropped region as a whole can be drawn from the strip shown in Figure 8.

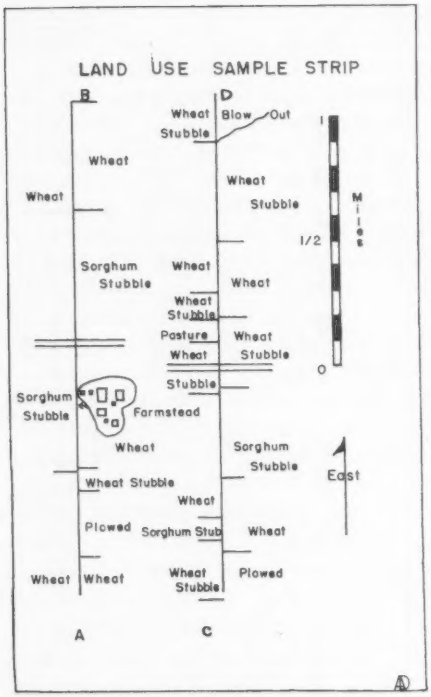

FIG. 8. Land use strip map of area approximately 7 miles west of Turpin near the Texas-Beaver County line. This strip was made in April, 1958, and it may logically be assumed that most of the plowed land and most of the stubble will be planted to sorghums.

yields of wheat within the Panhandle may exceed 15 to 18 bushels per acre, and individual areas may show yields in excess of 30 bushels per acre.[22] Grain sorghums show an analogous climatic relationship, but the yields are typically somewhat higher. It cannot be overemphasized that in the Oklahoma Panhandle averages in the normal sense are absurd, norms are nonsense, and means are meaningless.[23] Dry years presage the expansion of irrigation acreages, and wet years witness a certain apathy toward capital investment in irrigation facilities.

IRRIGATION AGRICULTURE

Though irrigation has produced marked changes in Panhandle agriculture, it has by no means completely revolutionized it. Irrigation began in earnest in the region about 1937, following quickly upon the heels of the dry years of the 1930's. In 1958 there were about 76,500 acres under irrigation in the area.[24] More than 95 per cent of the water is supplied by underground sources, which appear to be relatively abundant.[25] Irrigation from surface water sources is very limited and probably will not expand greatly.

The amount of land under irrigation and methods of irrigation vary considerably from county to county, but sources of water and types of crops raised under irrigation are quite similar from place to place within the Panhandle. To illustrate, Texas County has about 47,000 acres under irrigation, Cimarron County about 17,500 acres, and Beaver County about 12,000 acres (Fig. 9). Sorghum is the most important irrigated crop in each county and wheat is second in significance. Of the total irrigated acreage, something more than 55 per cent is devoted to sorghum and about 21 per cent to wheat. Secondary crops include alfalfa, corn, and pasture. A variety of other crops such

[22] Wheat yields in 1958 exceeded all previous records both in terms of total yield and per acre yield.

[23] Every competent observer in the field—soil conservation experts, county agents, and the farmers themselves—emphasizes the inordinate significance of climate upon crop yields. And, since climatic conditions vary so widely from year to year, so do crop yields.

[24] Robert B. Duffin (Extension Irrigation Specialist, Oklahoma State University): *Distribution of Irrigated Acres in Oklahoma, 1957*, mimeographed report, not dated, corroborated by county agents of each of the three Panhandle counties.

[25] Actual detailed water availability and recharge studies are underway, but definitive data on this matter are unavailable at the moment.

FIG. 9. Irrigation map of the Oklahoma Panhandle based on field study and reports of county agents. It is impossible on a map of this scale to pin down actual irrigated acreages, but the areas shaded represent those within which irrigation is most pronounced. (Based on field study and on county agent reports.)

as cotton and small grains accounts for the remaining acreage.[26]

Gravity irrigation is overwhelmingly the most important in Cimarron and Texas counties, and sprinkler irrigation is most important in Beaver County (Figs. 10 and 11).[27] Wells vary greatly in depth, but 300 to 400 feet appears to be typical, and there were approximately 360 operating wells in April, 1958. Drilling costs, leveling of land, preparation of surface tanks, installation of pumps, and construction of ditches vary greatly from time to time and place to place, but $9000 to $16,000 appears to be a reasonable figure for getting into the irrigation business in the Panhandle. Anticipated amortization of capital investment varies from five to ten years. Typical layouts of irrigation facilities may be ascertained from Figures 12 and 13.

Because of differences in amounts of water employed and in time of irrigation, it is extremely difficult to make a quantitative assessment of the effects of irrigation. Pre-irrigation for preparation of seed beds and germination of wheat is commonplace. In very dry years irrigation has proved to be the difference between crop failure and excellent yields. In "average" years it has meant the difference between a production of 11 bushels of wheat per acre

[26] Duffin, *op. cit.* Corroborated in large measure by county agents of each of the three Panhandle counties.

[27] "Water Supply and Irrigation in Each of the Three Oklahoma Panhandle Counties," *The Panhandle Bulletin*, No. I, Oklahoma Geological Survey, Norman, 1953. Details of establishing irrigation facilities and physical practices of irrigation may be discerned from three undated Oklahoma A. and M. College Extension Division circulars by Robert B. Duffin, *Irrigation Water from Wells*, Circular 645; *Surface Irrigation Development*, Circular 571; and *Sprinkler Irrigation in Oklahoma*, Circular 632.

FIG. 10 (left). A main irrigation ditch in the land south of Guymon. Note the flat terrain and the excellent texture of the cultivated soil. The water used in irrigation is so free of dissolved minerals that there have been no problems as the result of soils becoming alkaline.

FIG. 11 (right). Flood irrigation under way near Guymon.

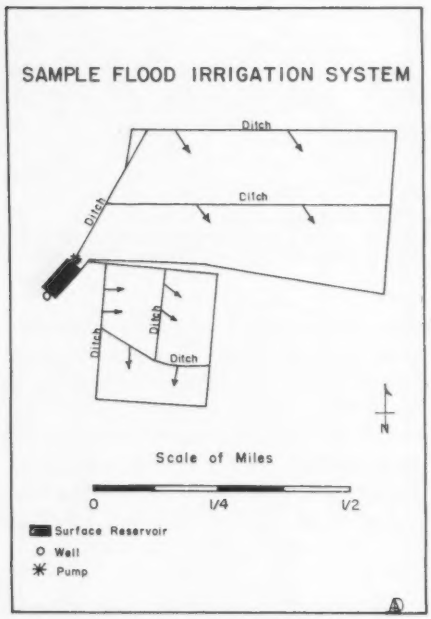

FIG. 12. Typical layout of irrigation system in Texas County. Map was drawn from aerial photograph. Wheat and grain sorghums are the two principal irrigated crops on this particular farm.

and 25 bushels per acre. Wet years slow down the development of new irrigation facilities, and dry years accelerate the rate of well drilling.

No one can say with any reasonable certainty how far irrigation may be expanded in the Oklahoma Panhandle. A complete inventory of water supply and recharge rates and a realistic loan program will undoubtedly permit some expansion of irrigation facilities. How far this extension may go is problematical. That irrigation fosters and adds a note of stability to Panhandle economy is undeniable.

GRAZING

In the Oklahoma Panhandle grazing competes with wheat growing as the chief user of land. Within the area are 16 ranches utilizing over 25 sections, or 15,000 acres, each (Fig. 14). The largest of these ranches covers 137 sections in Beaver County and continues into the adjoining county to the east of the Panhandle. It completely surrounds the village of Knowles. Numerous smaller ranches, occupying five to 25 sections, are interspersed with the larger ranches in the areas of rolling topography that border the Cimarron and Beaver rivers or their larger tributaries. The rich soils of the level uplands between the creeks and rivers are used for grazing purposes only when climatic and economic conditions make such uses feasible.

Beef cattle have always been the dominant domestic animal of the area. Even during the days of "No Man's Land" the larger cattle companies of Texas used the land for grazing. The Jones and Plummer Trail, one of the most used of the cattle trails connecting the ranches of West Texas with the railroads of Abilene and Dodge City,

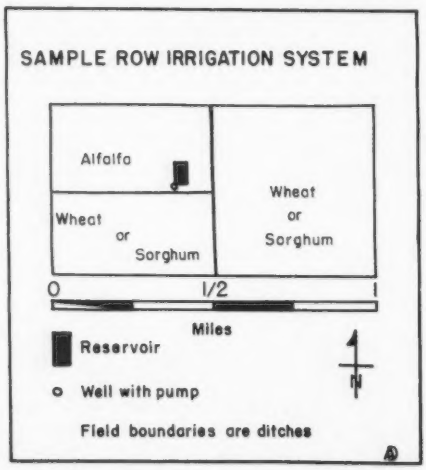

FIG. 13. Flood irrigation and row irrigation are quite similar, except that in row irrigation water is channeled more carefully to the crops than in flood irrigation where the water goes from the ditch to the field in rather haphazard fashion. This layout was drawn from aerial photographs and represents an irrigation system in Texas County.

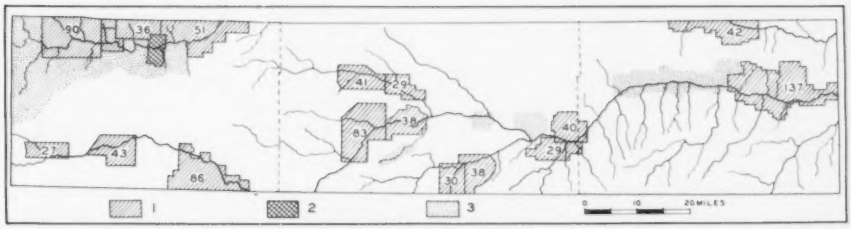

FIG. 14. Areas of large ranches in the Panhandle. Data obtained by personal interview with each of the county assessors in the Panhandle in April, 1958. Most of the ranches are found in the roughest, most dissected land, or in areas which have soil poorly suited to agriculture. Numbers refer as follows: (1) Ranches having more than 25 sections (number indicates sections in ranch); (2) Andy James River Ranch; (3) Areas with large ranches less than 25 sections in size.

crossed the area. Even though sheep were brought into the Panhandle at an early date, they never became an important part of the economy, partly because of the attitude of the cattleman, but largely because there were greater financial returns from cattle.

Since about 1925 the number of cattle in the area has varied with (1) climatic conditions, (2) the market demands for beef, and (3) the market demands for wheat. In 1925 over two million acres of Panhandle land was in pasture and had grazing upon it about 122,000 head of cattle—roughly one head for each 20 acres (Fig. 15). With the coming of drought conditions and the depression of the 1930's, however, the amount of land in pasture and the number of head grazed both dropped greatly, and the acreage-cattle ratio became about 30 to one. Since 1930 the amount of land in pasture has remained relatively constant, but the number of head of cattle grazed has fluctuated greatly. During the later 1930's, when climatic conditions were more favorable and economic conditions were improving, the number of cattle in the Panhandle more than doubled on only a slight increase in acreage. The ratio was then reduced to about one animal to each 11 acres. During the past decade this ratio has remained fairly constant. The county having the highest percentage of its land in pasture is Cimarron; Texas County has the smallest.

Although each large ranch is under a central management, not all the land in the ranch belongs to the operator. In many places land along the rivers is blow sand or sand and gravel. In a few places, especially in northwestern Cimarron County, topography is such that the land is not suitable for cultivation. Most land in such places as these was never claimed or, if claimed, was soon abandoned and again became state property. Such land, much of which is very satisfactory for grazing purposes, is rented to the rancher for 30 to 60 cents per acre per year. This

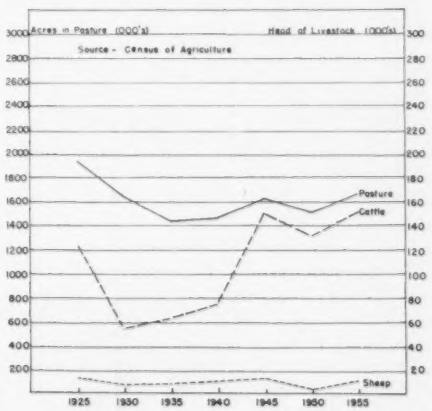

FIG. 15. Graph showing the relationship between amount of land in pasture and number of grazing animals in the Oklahoma Panhandle.

is an excellent arrangement from the ranchers' point of view, for often the rent is less than taxes would be. Also, the rancher can release the land at any time he does not need it. Thus, several ranches have considerably more rented than owned land.

Many of the ranchers in the Panhandle are now devoting full time to the grazing activity rather than trying to be part rancher and part farmer. The Andy James River Ranch is somewhat characteristic of this newer activity. Mr. James and his wife are both in their early twenties. He is a graduate of the College of Agriculture, Oklahoma State University. His wife specialized in Home Economics. With the help of his father, Mr. James has established his ranch of 16½ sections, or slightly over 10,500 acres (Fig. 16). Included within the ranch are approximately 12½ sections of state or public land, which is rented for an average of 50 cents per acre. In the spring of 1958 about 370 head of cattle were being run on the ranch, one head for each 20 to 25 acres. And while carrying capacities on natural grass pasture vary, it generally requires more than 15, and as much as 50, acres per cow in the Oklahoma Panhandle. Overgrazing has resulted in a substantial invasion of yucca, but the ranchers are in no hurry to eradicate it because the cattle seem to enjoy the succulent bud shoots in the spring. The River Ranch specializes in Herefords, as do most Panhandle ranchers (Fig. 17). In his south pastures James had 137 heifers, all registered and all bred by his own bulls. In the north pasture, beyond the Cimarron River, were 100 cows to be bred. In various other pastures were 133 steers which were to be marketed later in the year in either Kansas City or Denver. All stock is moved to market by truck.

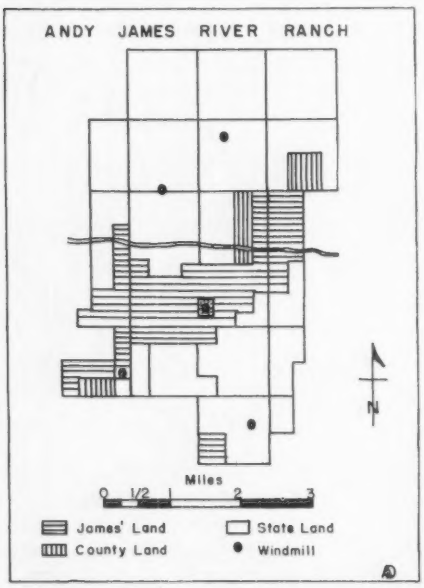

FIG. 16. Diagram of the Andy James River Ranch showing the relationship of privately owned land to publicly owned land. The stippled area south of the center represents the farmstead with several sheds, chicken houses, loading platform, barns, etc. The roughly parallel lines cutting across the middle of the map represent the course of the Cimarron River.

So far no attempt has been made to raise feed on the River Ranch. During those periods of the year when the native grasses are not sufficient a mixture of soybeans, cottonseed cake, and alfalfa pellets is fed the stock. The soybeans and cottonseed cake cost $75.50 per ton, the alfalfa pellets $60.00. Many ranches, however, are planting vast quantities of feeds. In most instances, when the material is not used, it is stored in long trench silos. Several ranchers were able to survive a brief drought during 1954–57 due to having a surplus of such feed on hand. In a few instances ranchers are producing feeds by irrigation.

A sufficient supply of water is always a problem to be considered in the Panhandle. The James River Ranch has on it four strategically placed windmills in addition to the water in the Cimarron

River. No animal is ever much more than one mile from water. Although the Cimarron is a sand-choked stream, it has some flowing water in it most of the time. Should there be no surface water, however, pools of water can be caused to form by removing 6 to 12 inches of sand. Some ranchers have built ponds or tanks by damming gullies. In many cases they have not proved satisfactory, since the soil is such that it absorbs rather than holds water on the surface.

Ranch life is not an unpleasant existence. Good automobiles and improved roads, many paved, put the most isolated ranches within less than an hour's drive of the county seat. The James ranch home is modern in every respect—running water, electricity from the local R. E. A., butane for heating. The five-room home had modern appliances, a radio, telephone, television, and wall to wall carpeting. It must be admitted, however, that the television is not too effective. Reception is received from Amarillo approximately 100 miles to the south, if atmospheric conditions are good and there is not too much dust in the air. A garage, a barn, two chicken houses, an electrically-pumped well, and a shed complete the homestead. A grove, probably planted for a former home site, furnishes shade.[28] Although many homes are not as well furnished as this one, most do have television and show other visible evidence of a satisfactory standard of living. The condition of the home is never to be judged by the looks of the outside of the house. Strong winds blowing for only a short period but carrying sand and gravel soon take the paint off the outside of the house.

One of the newer industries to come into the Panhandle is dairying. In Beaver County alone are 90 Grade A dairies, located mostly in the vicinity of United States Highways Nos. 64 and 83. Recently this county ranked second in the D. H. I. A. (Dairy Herd Improvement Association) in Oklahoma. Another dairying area is also developing

[28] Information obtained by personal interview with Mr. James in April of 1958 and used with his permission.

FIG. 17. A herd of good-grade Herefords characteristic of the Oklahoma Panhandle. The windmill and the watering trough are ever-present features of the Panhandle landscape.

near Felt in Cimarron County. Milk from these dairy areas is shipped daily to Amarillo by truck. Many farmers engaged in this activity are making determined efforts to improve their pastures. In addition to the conservation of native grasses by proper pasturing methods, they are planting a typical mixture of 14 pounds of blue grass, 11 pounds of sideoats grama, one pound of little blue stem, and one-half pound of switch grass seed per acre. Thus there is a determined effort to improve conditions and make a more profitable dairy industry.

OTHER ECONOMIC ACTIVITIES

Agriculture has been, and will no doubt continue to be, the most significant economic pursuit in the Oklahoma Panhandle. Most minerals are lacking, but petroleum and natural gas are most significant. The Guymon-Hugoton, Keyes, Mocane, and Laverne gas fields are of major significance to Oklahoma and of rather considerable importance to the United States as a whole. Oklahoma annually produces vast amounts of gas from its Panhandle Fields.[29] Recent indications are that the federal government will construct a $14,000,000 helium extraction plant near Keyes.[30] While oil and gas contribute significantly to the economy of the Oklahoma Panhandle, they are transitory assets which time will relegate to insignificance, while agriculture continues its dominance in the lifeblood of the region.

Manufacturing in the full sense of the word is nil, with only normal food processing industries being present. Future industrialization will remain insignificant, with the possible development of small industries dependent upon parasitic labor.

[29] The exact amount is unavailable because of the practice of keeping statistics on other than a county basis.

[30] *Guymon Daily Herald*, Guymon, Oklahoma, April 6, 1958, p. 1.

POPULATION

The three factors having the greatest influence upon population variations in the Oklahoma Panhandle are (1) the official opening of the territory for settlement prior to statehood, (2) droughts and the resulting consolidation of land holdings, and (3) the discovery of natural gas in the area. The United States Census for 1900 records a population for Beaver County, which at that time included the entire Panhandle, of only 3051 (Table I). Seven years later, at the time of statehood, another official census was taken that showed the population had jumped to 35,739. This is the largest population the area has ever recorded.

Between 1900 and 1907 all land in the Panhandle that had not been claimed by squatter rights, or set aside as school or government land, was opened to settlement. Every section was divided into four blocks of 160 acres each. Many a family moved to the area, staked a claim, built a sod shanty or half dugout house, dug a well, built a windmill to pump the water, and started to till the soil. They soon learned, however, that even under the most favorable climatic conditions most 160 acre tracts would not produce enough to support a family. Thus, shortly after statehood, the exodus started, and with the exception of the decade from 1940 to 1950 it has continued.

The decade having the largest migration from the area was that of the "Dust Bowl" years of the 1930's. During that period the Panhandle lost almost a third of its population. Many who remained bought the land of their less fortunate neighbors either directly or, more often, via tax sales.

TABLE I

POPULATION OF THE PANHANDLE

Year	*Population*	*Gain or loss*
1890	2,654	.....
1900	3,051	+ 377
1907	35,739	+32,688
1910	32,426	- 3,313
1920	31,459	- 967
1930	30,960	- 499
1940	22,198	- 8,762
1950	26,235	+ 4,037
1955*	25,510	- 725

*Bureau of Business Research, *Statistical Abstract of Oklahoma*, Norman, 1956.

Between 1940 and 1950 the area experienced an increase in population due to the discovery and development of the Hugoton gas field. Although wildcat wells have been drilled in each county, there has been little success except in Texas and eastern Cimarron counties. Thus, during this ten-year period the big influx of population settled in the central part of the Panhandle. Beaver County, which was outside the discovery area, continued to decline in population (Fig. 18). Since the limits of the field have now been approximately determined and production has steadied to conservation allowables, many of the workers have been transferred to other fields. The population of the Panhandle is now declining again.

Although agriculture and ranching are the chief activities of the Panhandle, 52 per cent of the 1950 population lived in incorporated villages, towns, or cities. In Texas County 65 per cent were urban dwellers as were 51 per cent of the people of Cimarron County. In Beaver County, however, 71 per cent are classed as rural. Guymon, the largest of the Panhandle "cities," and Beaver City have gained in population during each decade since their founding. Many former non-incorporated settlements have disappeared, and most of the smaller incorporated communities are decreasing in population. The only incorporated places to survive are those served by railways. The rural population is fairly evenly distributed throughout the area.

The Panhandle has always been a land of native born whites, almost 99 per cent of its population being so classed. In 1950 only 258 foreign born whites and 46 members of other races lived in the area. Only five Negroes and six Indians live in the three counties.

SUMMARY AND CONCLUSIONS

Statements made by the Great Plains Committee in the mid-1930's are as valid for the Oklahoma Panhandle in 1958 as they were when initially made. The Plains environment has meant different things to different men.

> Living as he did, the Indian could laugh at the burning sun, the strong but dustless winds. He had made his truce with them and with the land. . . . The White Man knew no truce. He came as a conqueror first of Indian, then of Nature. Today we see foothills shorn of timber, deeply gullied, useless or rapidly losing their fertile soil under unwise cultivation; the fertile earth itself drifts with the wind in sand hills and in dust clouds; where once the grass was rank, cattle nibble it to the scorched roots; the water of the streams and the ground

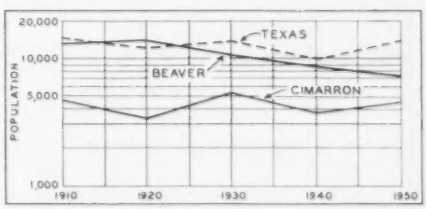

FIG. 18. Population curves of the Panhandle Counties since 1910. The effects of the "dust bowl" conditions of the 1930's can readily be seen in the precipitous drop of population between 1930 and 1940. (Data from *Census of Population* and *Statistical Abstract of Oklahoma*.)

> waters too often irrigate poor land, leaving the richer thirsty; men struggle vainly for a living on too few acres; the plough ignores Nature's "Keep Off" signs; communities, for all the courage of their people, fall into decay, with poor schools, shabby houses, the sad cycle of tax sales, relief, aimless migration. . . . The sun, the wind, the rain, the snow can be friends of man, not enemies. This is no Utopian dream. It is a promise to be realized if we will.[31]

This broken quotation summarizes an early history of conflict with Indians, an attack upon the land as though it were a humid region, and the "Dust Bowl" conditions so prevalent in the 1930's. Man still fights Nature in the Panhandle, but he has learned to compromise without shame, and to retreat when necessary.

The resources of the Oklahoma Panhandle are numerous, but the handicaps are many and varied. Pedocalic soils are, for the most part, of high inherent fertility. Moderately sloping terrain facilitates agriculture. Locally important and rapidly expanding irrigation facilities reduce some of the hazards of a capricious climate. Wheat and grain sorghums dominate agriculture, and ranching on the poorer lands is a major activity. Minerals, particularly oil and natural gas, are of some significance, but their impact on the region as a whole has not been great. Service functions of the communities within the region are typical, and manufacturing is negligible.

Agriculture and ranching will continue to dominate the land use pattern of the region. Irrigation will expand apace in the next few years, probably ultimately resulting in a depletion of water supplies. As long as irrigation water is adequate it will have a stabilizing effect on crop yields. Urbanization will probably increase in the larger communities, and many of the smaller communities will "die on the vine." Landholdings will increase in size and mechanization, already an accomplished fact, will reach new horizons. In the immediate future natural gas will assume increasing importance in helping to satiate the fuel demands of the East. In the somewhat more distant future oil exploration will probably increase, fostered by the demands of an expanding populace. Through all this, the Oklahoma Panhandle will undoubtedly continue to be a land of much empty space and a sparse population.

[31] "The Future of the Great Plains," *op. cit.*, pp. 14, 15, and 17.

ACKNOWLEDGMENTS

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THE STOCKHOLM MEETING OF THE INTERNATIONAL GEOGRAPHICAL CONGRESS

Your attention is called to the meetings of the Nineteenth International Geographical Congress to be held in Stockholm, August 6–13, 1960. We do not normally carry announcements, but an exception is made in this case since it is felt that every geographer should make a special effort to attend.

THE EDITOR

BOOK REVIEWS

The Upper Silesian Industrial Region, by NORMAN J. G. POUNDS. xv and 242 pp.; illus., maps, diagrs., index. Slavic and East European Series, Vol. 11, Indiana University, Bloomington, Indiana, 1958. $4.00. 8½ x 5½ inches.

This is an exceedingly interesting study of economic changes in the Upper Silesian Industrial District (the concept including the whole area of the Upper Silesian coal basin, covering approximately 4500 sq. km.) from the middle of the 18th century until today. It is thus a geographical-historical study, but one conceived in such a manner as to afford the best possible understanding of the changes that have occurred within recent time. Professor Pounds is the celebrated author of several brilliant studies in the field of industrial geography founded on history (including one on Lorraine and the Ruhr and the development of the French iron and steel industry).

His thorough mastery of the very abundant literature treating of Upper Silesia in various languages (English, French, German, Polish) is to be admired. This has made it possible for him to give a synthesis of the region discussed with an insight which even an author residing for a considerable length of time in the area would find it difficult to achieve. Literature concerning this area which constituted the object of so many political disputes in the course of recent decades is often biased and frequently renders correct and independent judgment difficult. The effort to maintain the utmost impartiality, distinctly felt throughout Professor Pounds' book, deserves underlining in the first place; it is the considered view of an accomplished, detached scholar—free from prejudice and emotional factors—who confronts source material with observed reality and forms his judgments on this foundation.

The first of the book's ten chapters gives a brief outline of the features of the geographical environment of Silesia and the physiographic regions, then speaks of the national situation and the degree of urban development in the mid-18th century ending with a discussion of the origins of mining. In chapter two the author sketches the principal trends in the development of Silesia in the latter half of the 18th century, emphasizing the important merits of such representatives of the Prussian economic administration as Heinitz and Reden in connection with the growth of the iron and coal mining industries. During this period Upper Silesia became one of the leading technological-industrial districts on the European continent. Chapter three contains a characteristic of mineral deposits with stress laid upon the most important elements, i.e., the Carboniferous coal deposits, the zinc-lead and iron ore contained in the ore-bearing Triassic dolomite, and the Jurassic iron ore deposits. The chapter ends in a discussion of geological investigations of Upper Silesia, among which the work of R. Michael, dating from 1913, and that of S. Czarnocki, dating from 1935, are considered as the most important.

The next chapter presents the growth of coal mining from the beginning of the 19th century until the First World War. The author quite rightly underlines the connection between the expansion of the railway network and that of extraction and marketing of Upper Silesian coal. In discussing the numerous positive technical features of the Upper Silesian coal basin favoring mining, he also points out the economic disadvantages of the area as compared with Western Europe. The cartogram on page 76 shows distinctly that already before the First World War the reach of marketing of the Upper Silesian coal was very similar to the present one, embracing primarily the territories which now belong to Poland.

A similar analysis of zinc and lead mining and metallurgy constitutes the content of chapter five, while chapter six gives an analogous image of iron metallurgy. Worthy of stress is the author's statement that, in the beginning of the 19th century, the zinc industry had better prospects than the coal industry, but subsequently its significance continued to decline, giving distinct priority to coal mining and to the iron industry, in spite of the fact that, as late as the year 1913, Upper Silesia provided 17 per cent of the world's zinc output. Lead became little more than a by-product of the zinc mines.

The analysis of the iron and steel industry contains a fairly detailed description of the emergence of individual industrial works and of the effect of changes in production processes on the gradual concentration of production. The author's statement that, while at the turn of the 18th into the 19th century Silesia was technically foremost in the iron and steel industry, after 1830 it was distinctly outdistanced by Western Europe, is very pertinent. A number of cartograms illustrate the distribution of foundry works in several time cross-sections; lucid diagrams represent the evolution of pig iron production and the proportion of local and non-local ore used in the smelting of iron in Silesia during the period reviewed.

In the next successive chapter the author

presents the situation in those sections of the Upper Silesian coal basin which belonged to Russia and Austria before the First World War, i.e., in the Dabrowa basin, in western Galicia, Cieszyn (Teschen) Silesia, and in Moravia. Treating them from an economic point of view as miniatures of Prussian Upper Silesia, the author emphasizes that there was very little cohesion and exchange between the four sections of this big coal basin; since every one of them lay near a State-frontier, each was able to sell its products only in a certain direction determined by the course of the frontier line, this making economic development more difficult and industrial practice more extravagant.

Chapters eight and nine present the economic changes that occurred in Silesia as a result of the new demarcation of frontiers and the division of Silesia between Poland, Germany, and Czechoslovakia after the First World War. Professor Pounds stresses the fact that in the heated strife between Poland and Germany for the possession of Upper Silesia both sides were unanimous in that the Upper Silesian industrial district should not be divided. But when the division was actually effected it proved to be less of a tragedy than could be expected, although it afforded material in abundance for German irredentist propaganda.

The last chapter discusses the present situation of Upper Silesia in connection with the socio-economic revolution effected in the countries of Eastern Europe. As the theme of this chapter Professor Pounds quotes the view that the industrialization of Eastern Europe is one of the most momentous facts in Europe's history; that it is irreversible irrespective of the future social and political system which may prevail in this area. In this chapter we find a succinct description of the most important changes that occurred in Upper Silesia since the time when it was incorporated with Poland in its entirety. The author underlines the important role of the coal industry in Poland, speaks of the successes and shortcomings of new industrial and housing construction, of efforts to improve the water supply of the industrial district, of attempts to improve transportation facilities. He concludes his book with a characterization of the landscape of the Upper Silesian industrial district where man-created features come to the forefront.

While the general level of the book is unquestionably high, we are conscious of a few minor deficiencies, chiefly of a historical nature. Thus, the major section of the Wałbrzych coal field including the town of Wałbrzych always belonged to Silesia, and the joining with it of the County of Glatz (Kłodzko) in the 15th century gave to Silesia only a small part of that basin comprising Nowa Ruda (p. 1). The section of Galicia situated on the left bank of the Vistula, i.e., including the coal basin, was annexed by Austria not in the first but in the third partition of Poland (p. 127). On page 141 the concept of the territory of Hlucin has been confused with that of Opava Silesia. The first belonged to Prussia during the period 1742 to 1920 and was annexed to Czechoslovakia by decision of the Council of Ambassadors in the year 1922, while Opava Silesia remained from the 16th century until the First World War within the boundaries of Austria and was taken over by Czechoslovakia in 1918. Before the period covered by the six-year plan (1950–1955) there was in Poland a three-year plan, not a four-year one as mentioned by the author on page 198. And, finally, in the legend to the map on page 45 the names of coal deposits—Randgruppe (Margin Group) and Muldengruppe (Basin Group)—should be reversed.

ANTONI WRZOSEK

Krakow, Poland

Ökonomische Geographie der Tschechoslowakischen Republik, by MIROSLAV BLAŽEK. 254 pp.; maps, diagrs., illus., tables, bibliogr. Verlag Die Wirtschaft, Berlin, 1959. 9.40 DM. 8¼ x 5⅞ inches.

Two important works on the geography of Czechoslovakia appeared in 1954, one in English and one in Russian: *Czechoslovakia* by Harriet Wanklyn (Mrs. J. A. Steers) (George Philip and Son, Ltd., London, 1954, 446 pp.) and *Chekhoslovakiia* by Professor I. M. Maergoiz of the University of Moscow (Geografgiz, Moscow, 1954, 311 pp.). A German translation has just appeared of a recent systematic economic geography of Czechoslovakia, *Ökonomische Geographie der Tschechoslowakischen Republik*, which is an abridged translation of *Hospodářský Zeměpsis Československa* by Dr. Miroslav Blažek, Director of the Laboratory of Economic Geography of the Institute of Economics of the Czechoslovak Academy of Sciences. This new book supplements but does not supplant the fuller work by Mrs. Steers, which is much stronger on regional, physical, and historical geography, nor the work by Professor Maergoiz, which is similar to Blažek's book in its section on systematic economic geography but which in addition has a substantial regional part.

Blažek's work has some admirable features. It has three excellent folding maps in the back pocket: administrative structure, relief, and agricultural types with pie graphs for industrial production of urban centers. The index of all place names mentioned in the text with a key to their location on the general reference maps saves the reader much needless effort in locating lesser known centers of production both old and new. The effective cartograms depict the distribution of many branches of industrial and agricultural production. But more important

is the detailed textual treatment of the current systematic economic geography.

The work begins with a brief and somewhat routine summary of the natural features: the surface, the raw materials, climate, soil, vegetation, and water resources. Then follows a discussion of the distribution of population and settlement. The most valuable section, occupying nearly two-thirds of the book, is the one on the economy. It is divided into three parts: industry, agriculture and forestry, and trade. Here will be found detailed descriptions of the distribution of industrial production of fuels, metallurgy, machinery construction, chemicals, and light industry, of the distribution of the principal crops and types of livestock, and of the transport system. Short sections describe economic relations with foreign countries and the major economic regions. The concluding chapter is a paean to the present governmental programs in raising production, living standards, and social welfare. An appendix, much shortened from the regional section of the original Czech text, provides brief characterizations of the economy of each of the 19 administrative regions of the country.

Among the major points made by the book are: The level of production of less-developed Slovakia is being raised much more rapidly than that of the rest of the country; the purpose is to increase the unity of the state. The foreign economic relations of Czechoslovakia have been reoriented from facing westward to facing eastward. The Soviet Union is now the major supplier of many raw materials, such as iron ore and wheat; the other peoples democracies are the principal markets for much of the manufactured produce of the country. The change in trade orientation has been accompanied by a shift in the means of transportation from railroad to river; 60 per cent of the international transport of bulk goods is now by the Danube (oil, ores, feed, and building materials from the USSR and the countries of Southeast Europe). Czechoslovakia as the most advanced economically of the peoples democracies is able to provide important machinery and industrial plants to aid in the industrialization of the entire eastern bloc and of some other underdeveloped countries as well. Under the present government, heavy industry has grown much more rapidly than consumer goods. (Consumer goods industries have declined relatively from 38 per cent of all industries in 1930 to 18 per cent in 1957.) The expulsion of the Sudeten Germans from the mountainous border zone of Bohemia resulted in substantial declines in some branches of industrial production and in the agriculture of some areas. These declines have been partly overcome by resettlement of population into these zones and by relocation of some of the factories outside them. The book throughout emphasizes the dynamic quality of the Czech economy and looks forward to needed and planned developments as well as backward to the earlier "capitalistic" era.

Summaries of some of the sections contain political clichés and simpliste and doctrinaire judgments on complex and controversial problems of economic policy and even of international relations. Thus Czechoslovakia is described as the most advanced country of the "peace camp," as though the Communist group of countries, or indeed any other group for that matter, had any monopoly on the desire for peace. Such naïve political propaganda is inappropriate in a serious scholarly or scientific work.

Most of the descriptive material of the book, however, is objective and, as far as can be judged, accurate. The book is a contribution to an understanding of the patterns of systematic economic geography of Czechoslovakia as of 1958.

CHAUNCY D. HARRIS
University of Chicago

Three Centuries and the Island, by ANDREW H. CLARK. xiv and 287 pages; notes, appendices, index. University of Toronto Press, Toronto, Canada, 1959. $10.00. 10 x 7 inches.

In few of the areas of geographical research is the influence of the individual writer and teacher so far-reaching for the course of the field as in historical geography. This is, in its way, paradoxical, since the method of historical geography is normally the method of current geographical study, applied to past time. Yet it has been empirically true in American historical geography that a handful of seminal thinkers—Semple, Barrows, Brown, and Sauer standing out—have impressed upon that branch of learning the stamp of their individual, powerful, and sometimes contradictory ideas. None of these pioneers remains in active university practice. Postwar changes in geographical research have altered our perspective on the past as well as on the present. What reconciliation of the conflicting elements in their own heritage, what adaptations of contemporary geographic thought and techniques to the geography of the past are to be made by the rising generation of historical geographers? In this thought-provoking little book, Professor Andrew H. Clark suggests some answers which lie beyond the substance of his study.

Prince Edward Island, because of its small size and physical homogeneity, has been called an ideal laboratory for the study of Canadian agriculture. Despite this homogeneity, Dr. Clark shows that considerable internal variety exists in the cultural patterns, and this diversity has existed from the beginnings of European settlement. Although the existence of the island was known to Europeans as early as 1534,

few contemporary descriptions exist for the early period, and the faint patterns of physical and biotic geography for the 17th century Micmacs' island of Abegweit must be reconstructed from later observations, theory, and contemporary records of nearby Nova Scotia and New Brunswick. Continuous permanent white settlement of the island was begun by the French about 1710, and census and other records of their Ile St. Jean permit of a more comprehensive reconstruction of the geographies of settlement and agriculture for the mid-century period. The systematic British, taking control of the island after the Peace of Paris in 1763, proceeded to Anglicize its name and run a land survey, the Holland Survey, which laid out 67 townships and 3 town sites on a rectangular grid pattern. This survey and its attached letter and report not only furnish a variety of information about the island's geography, but also provide convenient statistical units. These small areas permit the author to differentiate the island on a finer grain and map more precisely the regional differences in land use and population pattern in succeeding times. Through a fine piece of historical detective work he traces on map and in narrative the fluctuating settlement resulting from British promotion and American revolution until with the first British census, that of 1798, another general view of the island can be attempted.

With the end of the 18th century the island acquired its present name, and 19th century Prince Edward Island saw a great new influx of people, bringing with them differing types of cultural baggage and filling in the remaining lands suitable for agriculture. In the sixth chapter of the book, called "The Island One Century Ago," the most complete geographical account of population and land uses is presented, based primarily on the censuses of 1848, 1855, and 1861. This chapter is representative of the best that is in the book. Technique and substance are combined for an analytical geography in its historical frame. The narrative is carried from point to point by the maps—maps of distribution and density; maps of population numbers, origins, land tenure, arable land, grains, and livestock; maps of increases, decreases, ratios, and percentages of change. Chapters 7 and 8 trace the alteration in population characteristics and agriculture since Confederation, the maps and narrative here more oriented toward changes in the patterns. The summary chapter is a fresh appraisal of the detailed findings of the earlier sections.

Prince Edward Island is a place which history and historians have passed by. But even were its history as well known as that of Massachusetts, *Three Centuries and the Island* would still be an original and stimulating addition to our knowledge of the past. The secret is in the maps. In the words of the author, "All known relevant information has been utilized, but the distributional studies are basic." As a new variety of information about past place conditions, the maps are of value to the historian and reflect credit upon the geographer. Such maps are the warp and woof of a fine geographical study, the point of reference for its problem and the key element in its solution. The notes, grouped in the back of the book, make interesting browsing. The book lacks, however, a comprehensive separate bibliography.

If we turn for the moment to the work as an avowed experiment in method, what postwar emphasis in American geography has the author adapted to historical geography? Certainly the types and number of maps are important technical elements. This much emphasis on the precise intermediate-scale mapping of quantities and ratios has not been widely characteristic of historical geography. Second is the realization that the younger-minded geographers are not studying "regions" as once we knew them, but rather examining the regional pattern of selected phenomena, with other elements of the complex studied only as they affect the primary distributions. Professor Clark's study is not a historical geography of Prince Edward Island considered as the holistic study of an arbitrary unit of earth-space, but rather a historical geography of settlement and agriculture as it occurs within the spatial limits of Prince Edward Island. Within these limits, the patterns of the primary elements vary spatially; therefore their intra-regional variations and associations are studied. The third emphasis is the unhesitant use of census data and census-definable areas. Fourth, the work illustrates the postwar tendency to specialize in topical studies pointing toward comparison and contrast, although in this case within the limits of a common culture. For Professor Clark's corpus of past and projected work will be a series on aspects of a spatially varying process, the overseas settlement of the English-speaking peoples in widely separated areas. Each volume is complete in itself, but the method is to be constant and geographical.

How is our view of historical geography affected by this book? The earlier historical geographers represented some four different points of view, summarized in broad brush as environmental determinism, human adjustment, the cross-sectional view, and the culture-historical view (or "change through time"). At the present day the first two, although still taught, have disappeared as serious research concerns. The latter two have seemed opposing concepts to some. It is the genius of this book to take a long step toward reconciling them. The cross-sectional viewpoint is strengthened by applying it systematically and expressing the areal arrangement of phenomena on as many maps as possible. Dr. Clark fills in the interstices of this lattice of maps with the culture-historical viewpoint in a way which underscores

the changing nature of these patterns and the historical knowledge relevant to their interpretation. This resolution makes obsolete the pedantic distinction between "static" and "dynamic" approaches in historical geography. One map is static, two maps are dynamic. And what can be done with a map sets the pace for the handling of a problem in historical geography. In this connection, Professor Clark's comments at the beginning and end of the book are perceptive, and represent something of a methodological shift from his previously published remarks.

In sum, this unpretentious volume both continues and reinterprets some main intellectual currents in American historical geography. It provides for our day what Brown's *Mirror for Americans* did in its time, a substantive work bringing contemporary geographic thought and that of historical geography closer together. This book should be in the library of every college with a geography department, and many will wish it for their personal shelves. For its method, one must at least examine it to be *au courant* on the topic of historical geography; in substance, it is a meritorious contribution to the history and geography of a neglected area.

WILLIAM A. KOELSCH

University of Chicago

New India's Rivers, by HENRY C. HART. xvi and 301 pp.; maps, ills., index. Orient Longmans, Bombay, 1956. (Distributed by Institute of Pacific Relations, New York, $4.50.) 8¾ x 5½ inches.

This book about India's program of dam building and river valley development is a slick job of writing. Hart, who is professor of political science at the University of Wisconsin, is effusive in his admiration of recent Indian achievements, and, writing as he does with pamphleteering zeal, he should have no difficulty in infecting the reader with a sense of excitement and hope at the prospect of a near solution of India's desperate economic and social problems. He makes the claim that independent India's planning and implementation of river valley development schemes constitute a major social revolution and that India is now one of the most dynamic nations in the world because of what it has accomplished in the past decade. His book tells enthusiastically about these accomplishments, his story going from problems to the planning of solutions and finally to their realization.

Several large dams built during the past quarter century or still a-building are examined in turn, each being treated as a case study of one particular aspect of social and economic planning in India. Mettur and Krishnarajasagar illustrate conditions in the later British period with its peculiar territorial divisions; the story of Tungabhadra is chosen to show the effect of the sometimes violent transition in Indian life that occurred with independence and partition. The Damodar valley projects are presented as an example of the successful control of a flood menace in a densely populated agricultural region, flood protection being paid for by the development and sale of hydroelectric power. Hirakud demonstrates the need for local administrative control at the project site during all phases of development. Hart's evaluation of the desirability of having chartered corporations like the Damodar Valley Corporation rather than regular government agencies as at Hirakud as the planning and developing authorities for large dams makes a fine chapter; this is what the author seems able to do best.

Successive chapters give a glossy treatment to such topics as the difficulties of rapid mechanization, considerations affecting the choice between machine and human labor, living conditions of workers on the construction sites, ethical and economic aspects of population relocation, utilization of new electric power, and the education of the rain-farmer to use irrigation water on his crops and be willing to pay for it. For Hart, the problem is getting the farmer to use the water; he makes no reference to the possibility of excessive use of water by the unskilled irrigation farmer, without adequate provision for drainage, a feature of earlier irrigation development in the Punjab which led to serious soil damage.

It must be noted that the smooth quality of the writing does not always successfully conceal rough spots and hollow places. Some odd geographic statements appear. Does literary license permit sentences such as these two? "The Himalayas are as young as the Deccan is old"; "though in the monsoon the Deccan rivers bring down silt, it is the fine soil that fertilizes fields, not the coarse that clogs reservoirs." It is perhaps not surprising that with this neat solution at hand, Hart has little more to say of the allied problems of the life expectancy of the new reservoirs and the termination of soil replenishment previously afforded by periodic floods. The matter of relocating the population of the submerged portion of the Damodar valley is as agreeably settled: our attention is focused on the "model village" of Bachhai, with its bulldozed terraces, where, "with proper fertilization," the harvests may be as good as on the river bottom lands. The rose-tinted view extends to the coolie gangs of women and girls who do much of the hauling on construction jobs by toting 80 pound headloads: "work was hard, but it had a human rhythm."

The book does not pretend to be a comprehensive report of work accomplished. There is nowhere in the book, for example, a summary of the projects planned since independence and the work done up to the time of writing. This is a

pity. If Hart had set the facts out objectively and dispassionately, letting them speak for themselves, he could have done his subject greater justice. As it is, his uncritical adulation diminishes the reality of India's impressive achievements. And he has selected his material so that everything seems bound to come out right in the end. There is some suspense on the lines of "Will the dam hold?" But somehow we know it will. There is also a suggestion of conflict: the villains, who remain shadowy, marginal figures, are officials (petty, of course) accused of administrative malpractice, or they are misguided *mazdoors*, but we are given the impression that they will be straightened out in the finale, probably after hearing one of Mr. Nehru's speeches. So aseptic in fact is the moral environment of Professor Hart's world that time and again while reading the book I found myself wondering: this is India? We have assurance that it is from the author, who has, to use his own words, traveled widely "in second-class compartments of Indian trains."

The usefulness of the book is greatly enhanced by the inclusion of several exceptionally clear maps prepared in the University of Wisconsin's Department of Geography.

DAVID SOPHER

Sacramento State College

Une vallée Franc-Comtoise: *La Haute-Loue*, by R. Chapuis. Vol. 23 of Annales Littéraires de l'Université de Besançon. 222 pp.; maps, diagrs. Les Belles Lettres, Paris, 1958. 8¾ x 6¼ inches.

This monograph belongs to the distinguished series of small-scale studies that is usually regarded as an earmark of French geography. The author is concerned with a part of the valley of the Loue, a tributary of the Doubs. This valley, cut into the Jura plateau, is a typical *pays*, i.e. a micro-region with clear limits and a distinct personality. The author's task is to describe and explain the economic changes that have taken place in the valley during more than a hundred years. In dealing with this theme, he draws upon the results of intensive field work and patient research in local archives.

With the aid of old cadastral maps and historical records, the author is able to reconstruct the pattern of settlement and land use in his area during the first half of the nineteenth century. At that time there was a narrow band of pasture and cereal fields in the bottom of the valley, vineyards on the sunny slopes, and forests on the shady slopes. Within the valley settlement consisted of several large villages and two market towns. Most of the inhabitants of these settlements were landless farmers who worked for a small group of wealthy landowners.

The presence of a large number of landless farmers is still the most pressing social and economic problem of the valley. The French Revolution, like most revolutions, had little influence on the lower strata of society. Before the Revolution most of the land in the Haute-Loue was owned by nobles and the church. After the Revolution land passed to wealthy merchants. The work of cultivation continued to be assigned to hired laborers.

The persistence of this archaic pattern of land ownership was a powerful inducement to emigration. Farm labor grew increasingly scarce after the industrial revolution. The points of attraction were Besançon, and the small industrial towns of Franche-Comté and the Jura. As communications improved, depopulation of the rural districts and the competition of cheaper wines gradually destroyed the local wine industry. This is a prominent theme in the economic history of France. A century ago, almost every *pays* had its own wine. Today, local wines are less numerous and the best of them are exported. Most Frenchmen drink the wines of Midi and Algeria.

Another effect of improved communication was a realignment of circulation and trade. The markets and fairs of the Haute-Loue declined in importance when bus service was established between the valley and Besançon. Today the once important fairs function only as exchange centers for the manufactured products of the valley and the grains and animals of the plateau. The decline of agriculture resulted not only from the emigration to other parts of France, but also from the employment of landless peasants in the textile mills, tanneries, tile kilns, and other small industrial establishments of the valley.

Neither a regional study in the American sense of the expression nor a comprehensive historical treatise, this monograph is best described as an excursion into the borderlands of geography and economic history. Readers concerned with problems common to these two fields will be stimulated by this detailed study of an interesting part of France.

MARVIN W. MIKESELL

University of Chicago

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